JOURNAL OF ELECTRICITY

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Devoted to the Conversion, Transmission and Distribution of Energy

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BY CHAMP S. VANCE.

NET EFFICIENCY.
BY BENJAMIN F. PEARSON.

ELECTRIC DISTRIBUTION STANDARDS IN SAN DIEGO.
BY M. L. KLAUBER.

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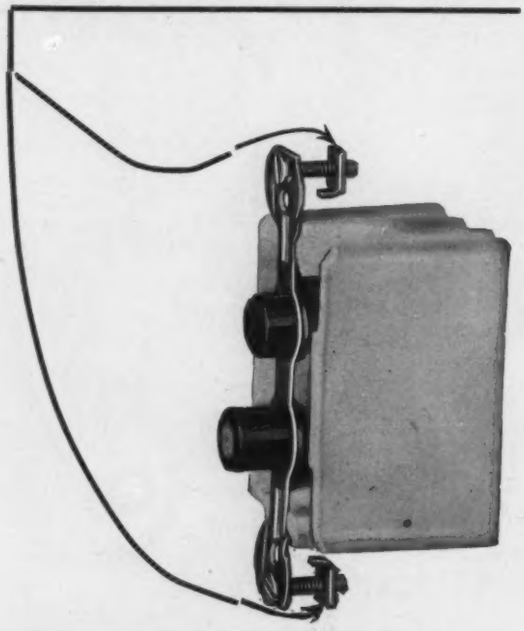

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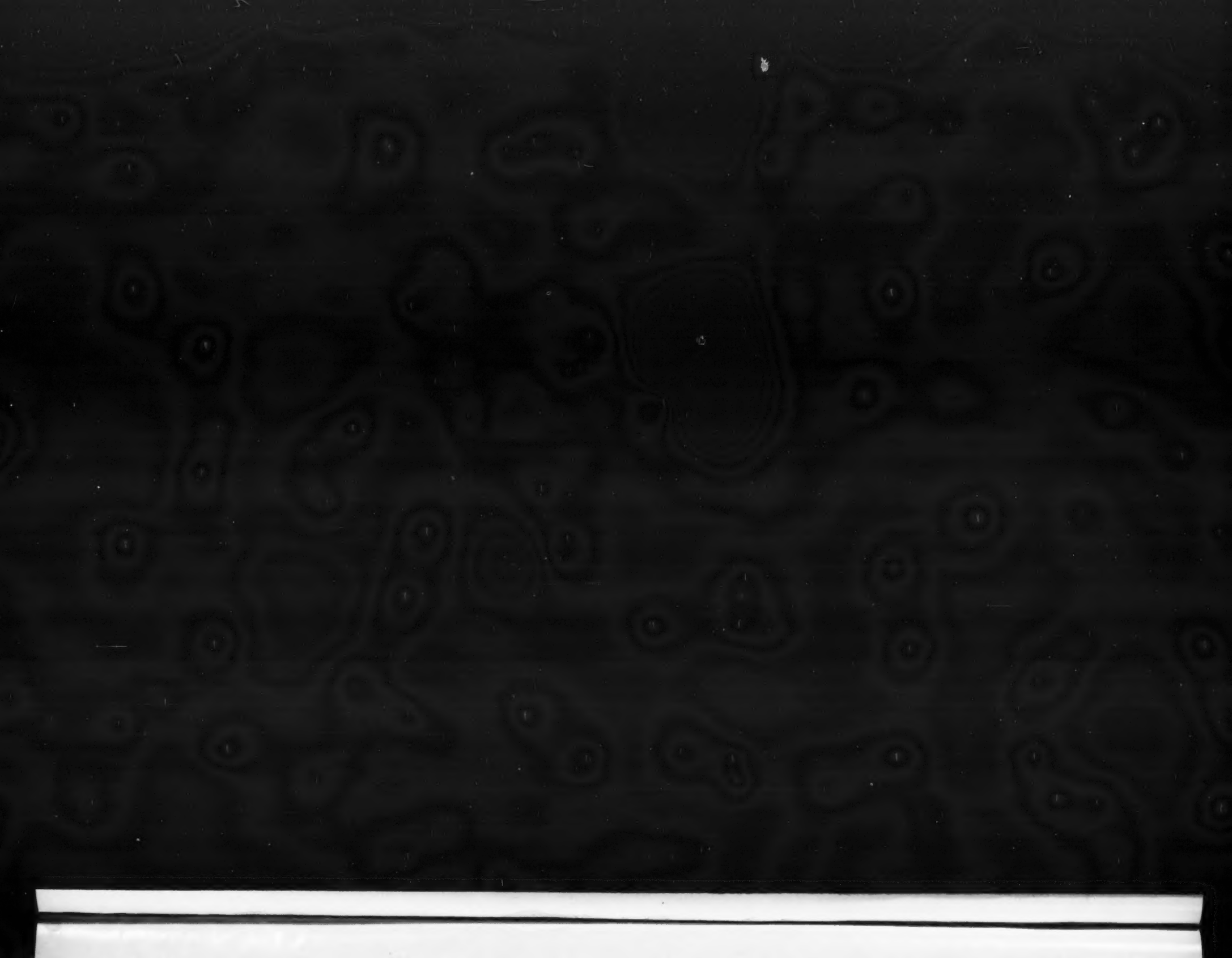

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POWER AND GAS
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PROGRESS IN THE GAS INDUSTRY

BY CHAMP. S. VANCE.

(This paper constitutes the presidential address of Champ S. Vance at the annual convention of the Pacific Coast Gas Association at Long Beach, Cal., September 15-18, 1914. Especial attention is devoted to legislation affecting utility companies, such as workman's compensation and to recent progress on the Pacific Coast.—The Editor.)

I welcome you to the 22d annual convention of the Pacific Coast Gas Association. My first duty is to thank you for the confidence you reposed in me last year in making me your president. I have tried to the best of my ability to prove myself worthy of the honor bestowed upon me, and I hope I have succeeded in discharging my duties to the satisfaction of all. If I have failed it is not because of lack of loyalty and support on the part of the members of this association.

CHAMP S. VANCE.

We assemble here to review the events of the past year in the gas industry and in our association; to benefit each other, our companies and the consumers by imparting any information we may have on subjects of mutual interest. When a group of men meet to discuss the progress of the particular business in which they are interested, each individual is bound to benefit thereby, and I sincerely hope that each member of the association present at this convention will take away with him some practical knowledge that will be of value to him and to the company which he represents. To this end I urge that we all take an active part in the proceedings which have been provided for this meeting.

The past year seems to have been one of many in bringing out unusual developments in our chosen industry. A number of us have had to contend with rate settlements; compensation laws more than held interest; and the advent of natural gas in some parts of California caused and is causing considerable thought and study. Generally speaking, the year ending will go down in history as one replete with sensations.

Judging from the practice of some of the larger companies, there seems to be a commendable activity toward the complete establishment of a standard gas oil best suited for the purpose. It is gradually being conceded that an out and out crude oil often times leaves much to be desired, and the topping of crude oil is slowly but surely coming into favor. Blending of gas and fuel oils is also being resorted to. It has been shown that this practice is one of merit, and in many cases the result is an excellent grade of gas oil, amply capable of producing a product well within individual city regulations. Right here it may not be amiss to add that this is a matter which, no doubt,

could profitably be studied, one well worth the reward, and I hope to hear from a number of you and of your success along these lines at our next meeting.

The manufacture of the carbon by-product into a finished commercial fuel seems to be coming into favor generally. Its excellent quality is being recognized by the consumer to such an extent that it is within reason to predict that "Old King Coal" in California, at least, will soon be routed. There is an inclination on the part of the manufacturers to dispose of this fuel, partially at least, through local tradesmen, thus insuring an even distribution during the heavy winter demands. Further it is an excellent advertising medium, and aids in the solution of the storage problem, where storage space is at a premium.

A large number of new gas appliances, of greater or less merit, seem to have become very prominent. It certainly behooves the appliance men, as well as the gas men generally, to make an investigation of all of these and concentrate efforts upon such as they are assured will best serve the consumer.

Since our last meeting there has been placed upon the statute books of California a new law, far reaching in its consequences, and of especial interest to the gas companies and other public utilities of California. I refer to the so-called Workmen's Compensation, Insurance and Safety Act. This act, in its nature altruistic and designed for the better protection of the workman, establishes a principle of compulsory compensation for industrial accidents; takes from the employer coming within its provisions, the question of the compensation to be made in cases of personal injury to or the death of an employe in the course of his employment, and places such matters in the hands of a board created thereby, and known as the "Industrial Accident Commission." Upon schedules prescribed by the act, the extent of the injury as regards the disability of the injured employe or his death, is correlated with his earning power, expressed in terms of average earnings, and certain fixed sums are prescribed, adaptable to each individual case, to be paid to the injured employe or to his dependents, in installments or as a lump sum. The act further creates a state compensation insurance fund to be administered by the said accident commission for the purpose of insuring employers at their option against liability for compensation thereunder, and provides for the making and enforcement, by such commission, of safety rules and regulations applicable to employers.

The act is not without its faults, and serious ones, which should be remedied. It bears more heavily upon the small employer and the poor man than upon the larger corporations and the man of wealth. For instance, Section 30 thereof places upon the principal the liability for injury to the employe of the independent contractor. This might result in saddling upon a poor man who desired to build a cottage at a cost of not exceeding two thousand dollars, perhaps, the entire liability for the permanent disability of an employe of the carpenter who had contracted to build such cottage. This would inevitably have the effect of driving the poor contracting carpenter or the small contractor out of business in favor of the larger and wealthier corporations or contractors.

The act has the effect of abolishing one class of damage cases and jury trials, except in cases where the injury or death is caused by the personal gross negligence of the employer, an elective officer in the case of a corporation, and will result in the prescription and adoption of certain safety standards and devices. Practically, it will resolve itself chiefly into the matter of a slight increase of operating expenses for insurance, and a greater vigilance in the observance of the safety first doctrine. Many large corporations will, of course, be their own insurers.

While the increase in membership in the association during the past few years has been very gratifying, we must not rest content with what has been accomplished in this connection. When we consider the great number of gas companies operating on the Pacific Coast and note the small proportion of these represented in our organization, we are confronted with the urgent need for missionary work. If the gas companies, not now represented in our organization, could be made realize the benefits to be derived from membership therein, I am sure that they would have no hesitancy about joining. It cannot be claimed that the expense connected with the membership prevents their enrolling with us, for the dues are insignificant and the annual cost of sending representatives to the convention is small. Men attending these conventions cannot fail to increase their knowledge of the progress in the manufacture and distribution of gas, by the interchange of thought on these subjects. The advantages to be gained by affiliation with an association such as ours are so apparent that a review of them would be superfluous.

In 1905 our Association first began to take an active interest in the question of the establishment of a course in gas engineering in one of the Pacific Coast universities, and at our convention that year a committee was appointed to take charge of this work and to consult with the heads of the universities regarding the establishment of such a course. The efforts of the committee did not bear fruit until last year, when a course leading to a degree in gas engineering was instituted in the University of California. Mr. J. A. Britton will tell us about the results being obtained at the University, and will report on what his committee has done since our last convention.

Just a few words regarding the International Gas Congress. The year 1915 should mark an epoch in the history of our association. We have agreed to act as host to what is hoped will be the greatest gathering of gas men ever held in this or any other country. Efforts have been made to have as many gas associations as possible hold their meetings in San Francisco during the week of the Gas Congress, and we hope that they will all find it expedient to do so. Many of the foreign associations have also signified their intention of sending representatives to attend this meeting. We have assumed a big contract, and to successfully perform it, we must have the aid and co-operation of all our members. I am sure that the committee in charge of this matter will appreciate any suggestions or assistance offered by the individual members. Mr. J. A. Britton, chairman of this com-

mittee, has prepared an interesting report on the progress made by his committee since the last convention, and I ask that you give his paper your earnest attention.

At our last convention we adopted a rule that all parts to be presented at our meetings be in the Secretary's hands on a date named by him, and that they be printed and copies distributed to the members in advance of the meetings. The carrying out of this plan should be a source of great satisfaction and benefit to all of us, as it gives each member an opportunity to study these papers and prepare for their discussion. I hope that the gentlemen who prepared papers for this convention have assisted the secretary by complying with this rule.

Each year there is an increase in the number of members who wish to take an active part in the discussions which follow the presentation of papers, but recent years, though the number of papers has been held to a minimum, owing to lack of time, some of these gentlemen have not had the privilege of being heard. Also, it is only fair to the authors that their contributions, on which they have spent much time and labor, receive careful and thorough consideration, but we have found that this is almost impossible in a three days' session. Therefore, we have arranged to have the convention, this year, extend over a period of four days, and we hope that, in this way, everyone who cares to will be afforded an opportunity to give us the benefit of his opinion and experience on the problems presented.

Two of our members were claimed by death since the last meeting, Mr. Geo. S. Colquhoun of San Francisco, and Mr. E. F. Murphy of Modesto, Cal. Mr. Colquhoun joined the association at its sixth convention, and was president during the year 1909-10. Mr. Murphy joined the association at its eighteenth convention. Both were respected by all with whom they came in contact, and we will miss them at our annual meetings. Suitable resolutions will be drafted by our memorial committee and placed upon the records of the association.

In conclusion I extend thanks to all those who have contributed their time and efforts toward making this meeting a success. The work of Mr. Henry E. Bostwick, as secretary, is especially commendable. He has devoted many hours of labor to the affairs of the association, and we should show our appreciation of the work done by him and his associates by making this convention the most memorable and profitable in the history of the association.

Our twenty-second annual meeting is now in your hands. I thank you for your courteous attention.

Motor delivery vans of one of London's largest tobacco firms have been equipped with wireless apparatus in order that help may be rushed to needy smokers on the receipt of the signal S. O. S.—meaning, "Send On Smokes." This firm claims to be the only one in the world using the wireless in its delivery system. The firm communicates through a station on the roof of the building. Aerials are placed on the vans, manipulated by an operator inside.

ELECTRIC FLAT IRON CAMPAIGN.

BY H. S. WELLS.

(In this paper Mr. Wells, who is new business manager for the Pacific Power & Light Company at Portland, Oregon, tells of a successful campaign whereby 650 electric irons were put into so-called saturated lines. Its suggestions may well be followed by other companies.—The Editor.)

The electric iron has so far outstripped other electric appliances in general public use that today the household not equipped with an iron is the exception rather than the rule, and a central station finds the percentage of iron saturation very high among its customers.

To inaugurate a flat iron campaign, therefore, means reaching a comparatively few widely scattered prospects, and to be successful this must be accomplished at a low cost, as the earnings from an iron, either through energy consumed or profit on sales, are too small to justify much expense. Consequently, the ideal solution is to get the prospects to come for the iron rather than to go to the prospects.

This was successfully accomplished by the Pacific Power & Light Company in a flat iron campaign over its properties last spring. The much-used bargain offer proved again its worth, for in spite of the high per cent of saturation on irons, the company sales for the campaign exceeded those of any previous spring campaign, and this effected at a minimum cost. The bargain advertised was "An Ironing Board Given Away With Every Flat Iron Purchased at the Regular Price of $3.50."

The ironing board was of the latest and most up-to-date folding type, manufactured in Portland by the Oregon Woodenware Company, and is being handled by many of the leading mercantile stores in this section of the country at a price varying between $2.50 and $3.00. The bargain was obvious to the feminine mind and was sufficient in itself to draw a multitude of inquiries, and resulted in a large number of purchases. In order to keep the name of the company in the mind of the user, a stamp reading "Electric Ironing Board—Pacific Power & Light Company," was placed in a conspicuous place on each board.

Newspaper and window display, together with descriptive dodgers sent out in the monthly bills, were the mediums of conveying the offer to the public, and represented the only expense of the sale.

Before the campaign started it was estimated that there were 1800 lighting customers not using irons. Of this number, 20 per cent were eliminated as non-prospects, leaving 1456 prospects. The campaign resulted in "landing 40 per cent of these prospects, thus putting some 650 irons on the company's lines. All expenses of the campaign were paid from the profits on the merchandise. In large quantity shipments the ironing boards were laid down f.o.b properties for approximately $1 each, and as the combination iron and ironing board sold at $3.50 there was a fair margin of profit.

Germany's two greatest electric manufacturing companies are the Allgemeine Gesellschaft and the Siemens and Halske Company, which together have a capitalization of nearly $52,000,000, and last year did a business of about $170,500,000.

NET EFFICIENCY.

BY BENJ. F. PEARSON

(In epigramatic and forceful language the author explains the meaning of net efficiency and illustrates its application in the conduct of an electric power company. Mr. Pearson is general superintendent of the Southern California Edison Company of Los Angeles.—The Editor.)

In the space at my disposal it will be impossible to even touch on many phases of the question that suggest themselves as being necessary in a discussion of the subject, efficiency, particularly "net efficiency."

Efficiency is the keynote of progress; the secret of success; is the exclamation point between profit and loss; it spells maximum service, courtesy, patience, co-operation, and untiring efforts; it rings down the curtain on laziness and indifference, and goes on with the task after the clock points to the hour of quitting time; it knows no limitations of effort; no departmental boundaries. Its watchword is vigilance and its tocsin, endeavor.

Efficiency is never satisfied. Its ultimate goal is never reached. It is always striving to do the task better, to accomplish more within a given time; more, with the material and equipment in hand. It never measures out a certain quantity of work for a given compensation; it is the additional mile per gallon of gasoline; the extra kilowatt per barrel of oil; the vital attention to every detail of operation which will reduce cost to a minimum, and give the greatest measure of service for every dollar expended. It involves the principle on which every real success is founded. It is the only substitute for municipal ownership, and the court of last resort between utility corporations and regulating commissions.

In mechanics, efficiency is the ratio of useful effect to the expenditure of energy. It is just as true of every department which makes up the organization of a public utility corporation, as the ratio of useful effect to the expenditure of energy, in any department, whether it be manufacturing, construction, transmission, distribution or sales, contributes to the profit or loss of the product marketed.

I have been asked to refer briefly to the efficiency of a tungsten filament lamp on a consumer's premises, compared with the fuel oil used to generate steam for power purposes. The average layman does not comprehend the enormous losses involved between the boiler furnace and the light, and without going into tiresome detail, it will be sufficient to state that of the initial energy contained in a barrel of oil, approximately only one-quarter of one per cent reaches the consumer in light—"candle power." By the various processes of combustion, radiation of heat, generation, transmission, transformation and distribution, 99.75 per cent of the initial energy in the fuel oil is lost.

The following table, for the sake of illustration, segregates the principal items, showing the approximate efficiency of the different elements of production and distribution under average normal operating conditions: Energy from fuel oil to tungsten lamp light:

	Per cent Efficiency.	Energy.
Fuel oil	....	100
Boiler and economizer	85	85
Turbine	19.8	16.8
Generator	96	16.1
Step-up transformers	98.5	15.9
Transmission line	90	14.3
Step-down transformers	98.5	14.1
Distribution	90	12.7
Tungsten lamp	2	0.25

For the sake of comparison, and to more clearly bring out the relation between the raw material and light, we might compare the system to a mint, the results obtained are the same as though we gave to the mint in raw material one dollar, and after passing it through the processes of coinage, only one-quarter of one cent was obtained; or, for every $4.00 in raw silver one cent; for $1000 only $2.50.

To bridge this gap the greatest minds of the engineering world have devoted their energies. Laboratories involving millions of dollars, and the unstinted devotion of thousands of men are engaged, and every new development, involving the slightest improvement in efficiency is considered a tremendous advance in the art.

We are all familiar with the old trite saying, that "the individual who makes two blades of grass grow where only one grew before, is a benefactor to the human race," but in this present day when fuel and light are of prime importance to the welfare of the entire world, the "individual who can make" two kilowatts "grow" where only one grew before, is of even greater importance and in a much larger sense a benefactor; and while scientists and engineers are engaged in the struggle with inefficiency, the operating forces are often negligent of the tremendous possibilities in their power, enabling the company to sell the finished product to the consumer at the state of highest efficiency. A recent case brought to my attention serves to illustrate one point:

A certain factory which had been engaged in one line of business for twenty-five years, changed management. The new manager immediately posted a bulletin inviting all employes to make recommendations which might involve a reduction in the cost of manufacture, offering as an incentive a bonus and increased salary for all accepted ideas. "Dobbs" was foreman in room No. 4; Dobbs, thought, and finally hit upon an idea which would reduce his operating force 50 per cent; with a great deal of elation he informed his wife of his discovery; then came the query, "What will happen to Smith, whose wife is paralyzed, and Jones, who is buying a house on the installment plan, and Brown, who walks lame as the result of a broken hip"; Dobbs procrastinated and postponed making the recommendation from time to time. Two months later the new manager called Dobbs in and informed him that his services would not be required after the end of the following week; that one of the men in Dobbs' room had made a recommendation which would reduce the working forces 50 per cent, and had been appointed foreman in Dobbs' place.

While it was commendable in Dobbs to be concerned for the welfare of the other fellow, his first consideration under the circumstances was his employer's interests, which involved, as was seen, his own welfare; and better than this, the reduction in operating expense made it possible for the factory to increase its output, marketing the product at a lower price and the men in room No. 4 were reinstated after a short vacation, in other lines of employment.

Net efficiency spells the existence of the company; the existence of the company directly affects the welfare of every employe, officer and stockholder. Net efficiency operates directly on the pay roll, and each

employe in the company's service is contributing, not simply to his own welfare, but to the existence of the company, and to the general welfare of the community at large. Every minute during working hours, of each employe, is contributing for or against the desired and absolutely necessary result, namely, the marketing of the company's product at a price which shall pay all the necessary expenses, and return interest on the investment. The relation between the dollar invested by the stockholders and the cost of the physical property on which is based the price of the commodity, is one of the greatest tests of efficiency. If one pole in a given line, due to laziness or lack of attention or wrong methods, costs $5 more than any other pole in that line, then that particular pole is burdened to the extent of earning not less than 50 cents per annum more than its fellows; and it is a direct charge, absolutely unavoidable, against every kilowatt carried over the line.

Every man engaged in construction or the installation of new apparatus is contributing directly to the net efficiency and is fixing a charge upon the books which can never be altered by any economies in operation. The man who is vigilant and constantly observing the rules of the game will study to see how every given process in the work may be reduced as to time and in the use of material. Every dollar saved is 10 cents gained. The responsibility begins with the construction men and ends with the operating department. The fireman regulating the volume of air taken into a furnace has a direct relation to the net efficiency of the company; and every employe in every boiler room and engine room should be constantly on the alert to operate at the highest point of efficiency, and on the other hand, the greatest economy, stopping leaks, not only in leaky joints, but remembering that every drop of condensate water represents a given amount of fuel oil; every drop of machine oil wasted is contributing to the operating expense and reducing profits, and making more difficult the problem of rate adjustment between the corporation and municipal governing bodies.

Every man who by careless methods destroys material, whether it be a piece of copper wire, a bolt, a cross-arm, or any other element entering into the construction of the company's property anywhere, is contributing to increasing fixed charges and the operating expenses.

"Oh, that's good enough," is a remark only too commonly made by the average individual working for a living; and it will be found in every instance that where this is the motto back of a man's relations to his employers, that particular individual will never succeed. Neglect, indifference, "don't care," are all friends of inefficiency and failure, and all help to retard the machine as a whole. Promptness in beginning work and leaving only when the task is done (should it be necessary to finish it today), and the response "Aye, aye, sir," to every demand, no matter whether it involves the particular work of the individual, or the digging of postholes by an accountant, the operation of a substation by a department head, —"We worked fifty hours straight, but we got 'er on the line,"—is the spirit that spells efficiency.

It will be also found that co-operation as between various departments—the employes in the departments —is absolutely essential to the best results. We point with a great deal of pride to our "Edison Spirit," which involves many of the elements which have been referred to as being contributory to the highest state of efficiency. The man who sees a task to be performed, but who because it is not in his department, answers, "Let Bill do it," or "That's none of my business," is not a loyal employe in any sense of the word.

The spirit of co-operation has been well exemplified during the past month or two, when strenuous methods have been adopted looking to the reduction in operating expense to meet the unsettled conditions. In some instances, in reducing our forces, it has been necessary to suggest to sub-foremen in the electric distributing department that they could contribute to the desired result by putting on a pair of spurs and "climbing with the rest of the gang." In no instance has this request met with a refusal, but in every case there has been instant approval of the measure, and men who have not worn spurs for a number of years are today "climbing" to the top of the pole, actually and figuratively, in response to the request of our general manager, that every economy of every character should immediately be put into effect. This is the spirit that wins the game, and the Southern California Edison Company is justly proud of an organization that responds to every exigency, and the general superintendent is able to say, that at no time, during the period of his office, has he ever made a request or a demand which has not been met with instant and hearty obedience, so let us continue to pull "altogether, with a long pull and a strong pull," and the net efficiency obtained as the result will be gratifying to all concerned.

History teems with examples in every walk in life; men who have risen by dint of their own effort and who lead the professions. In every instance it will be found that each man kept constantly in view the thought, how to better perform a given deed, using less time and less material. A man will find conditions crowded at the bottom of the ladder; the higher up, the more room, and it should be the aim of every employe of the Southern California Edison Company to contribute to its existence by putting forth every endeavor that shall result in a greater net efficiency, making successful competition impossible and municipal ownership unnecessary.

Hand fired boilers of the return tubular type can be fired without violating the smoke ordinances of most American cities with proper boiler-room supervision. According to the investigations of the U. S. Bureau of Mines the prevention of smoke may be more easily accomplished when the coking method of firing is employed than when the alternate-spreading method is used. The use of supplementary air immediately after firing tends to increase the over-all efficiency and in the production of more smoke. The screening of heating surface in the combusion chamber from direct radiation from the brickwork tends to lower the combined efficiency.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

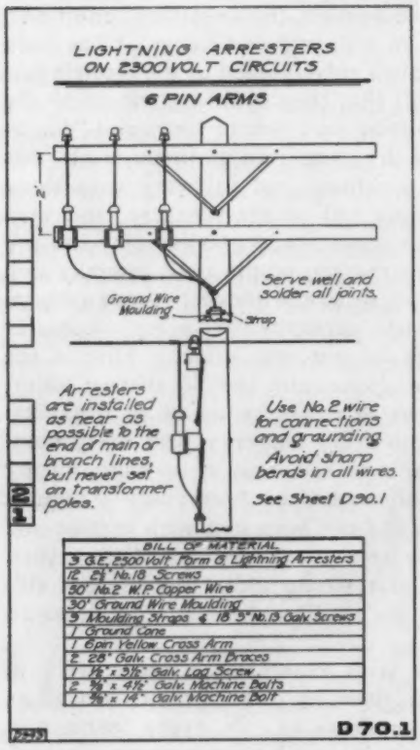
BY L. M. KLAUBER.

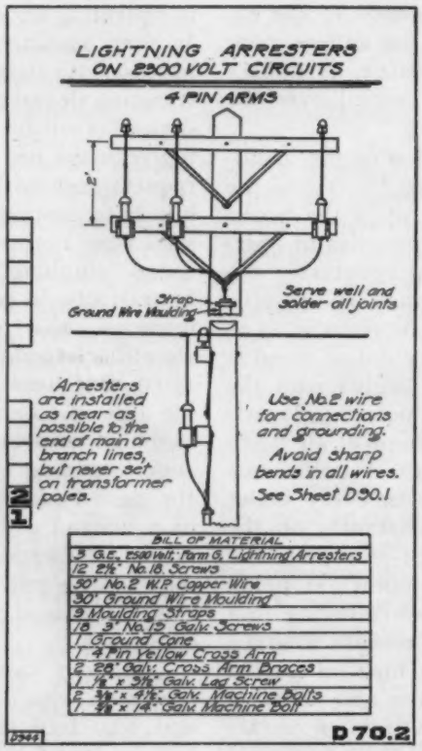
D. Overhead Construction.

[Continued.]

D. 70: Lightning Arresters. Sheets D 70.1 and D 70.2 cover the standard method of mounting General Electric compression chamber arresters on 2300 volt lines.

D. 80: Switches. These sheets show the standard method of mounting 11,000 volt, three-phase, air break switches of the K. P. F. type. These switches are used at all points where lines branch from the main circuit or where the main line is sectionalized. The method of mounting indicated in Sheets D 80.1 and D 80.2, employing a special dead end arm, is used where the spans on either side of the switch pole exceed 180 feet. Where the spans are less the lines are dead ended directly on the switch as shown in D 80.3 and D 80.4.


LIGHTNING ARRESTERS
ON 2300 VOLT CIRCUITS
6 PIN ARMS
Ground Wire Moulding
Strap
Serve well and solder all joints.
Arresters are installed as near as possible to the end of main or branch lines, but never set on transformer poles.
Use No.2 wire for connections and grounding.
Avoid sharp bends in all wires.
See Sheet D 90.1
BILL OF MATERIAL
3 G.E. 2500 Volt Form G Lightning Arresters
12 2½" No.18 Screws
30' No.2 W.P. Copper Wire
30' Ground Wire Moulding
3 Moulding Straps & 18 3" No.13 Galv. Screws
1 Ground Cone
1 6 pin Yellow Cross Arm
2 28" Galv. Cross Arm Braces
1 ⅝" x 3½" Galv. Lag Screw
2 ⅝" x 4½" Galv. Machine Bolts
1 ⅝" x 14" Galv. Machine Bolt
D 70.1


LIGHTNING ARRESTERS
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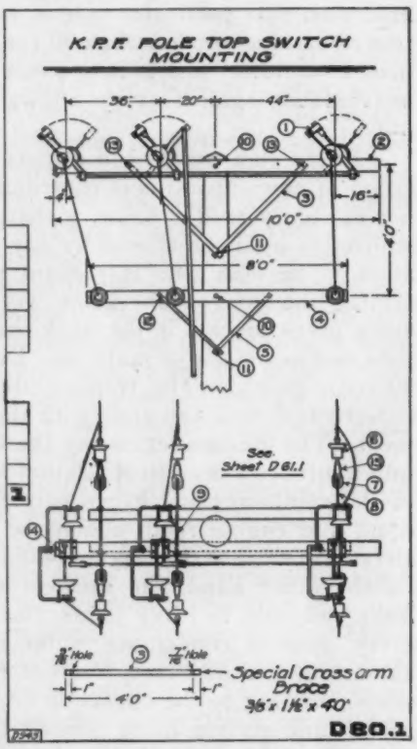
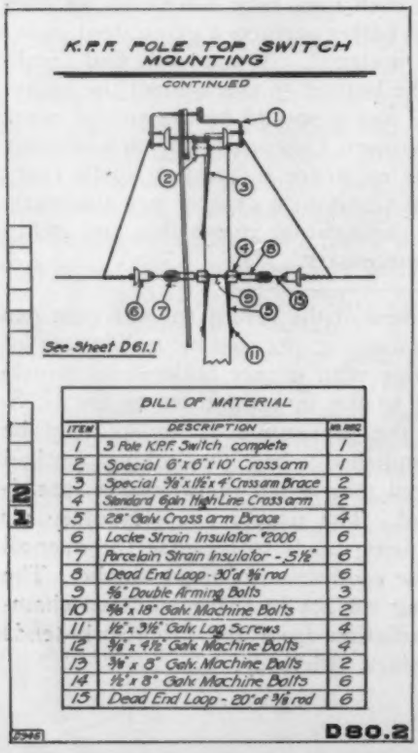
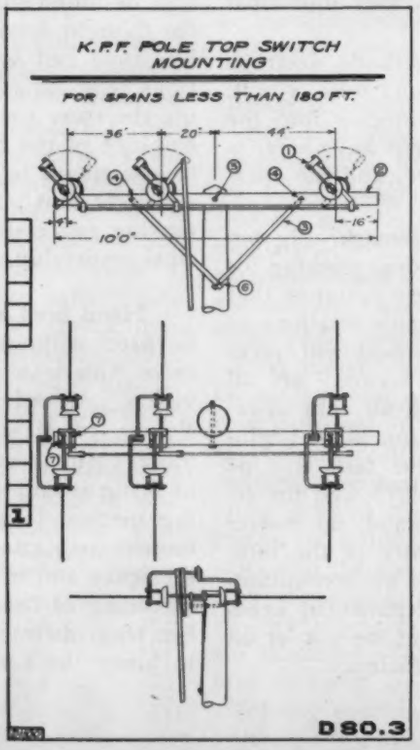
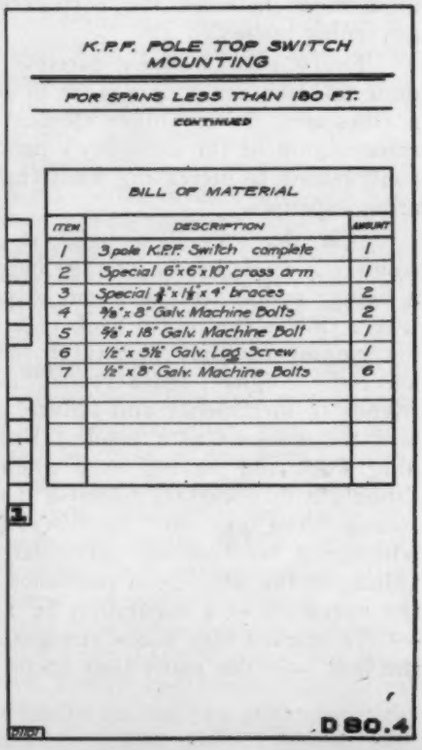
Avoid sharp bends in all wires.
See Sheet D 90.1
BILL OF MATERIAL
3 G.E. 2500 Volt Form G Lightning Arresters
12 2½" No.18 Screws
30' No.2 W.P. Copper Wire
30' Ground Wire Moulding
3 Moulding Straps
18 3" No.13 Galv. Screws
1 Ground Cone
1 4 Pin Yellow Cross Arm
2 28" Galv. Cross Arm Braces
1 ⅝" x 3½" Galv. Lag Screw
2 ⅝" x 4½" Galv. Machine Bolts
1 ⅝" x 14" Galv. Machine Bolt
D 70.2

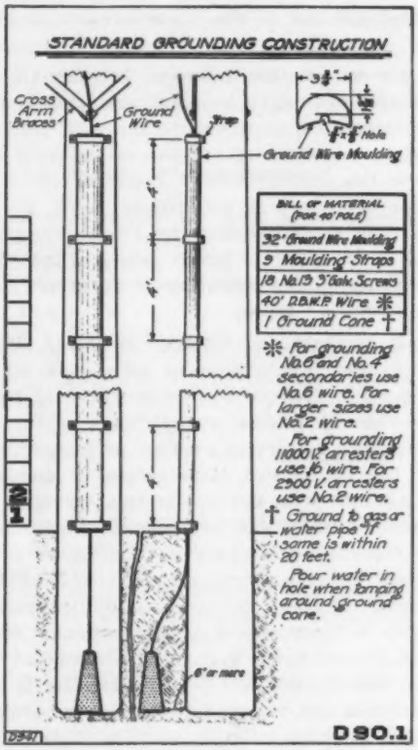



K.P.F. POLE TOP SWITCH MOUNTING
CONTINUED
See Sheet D 61.1
BILL OF MATERIAL
ITEM | DESCRIPTION | NO. REQ.
1 | 3 Pole K.P.F. Switch complete | 1
2 | Special 6"x6"x10' Cross arm | 1
3 | Special ⅜"x1½"x4' Cross arm Brace | 2
4 | Standard 6 pin High Line Cross arm | 2
5 | 28" Galv Cross arm Brace | 4
6 | Locke Strain Insulator #2006 | 6
7 | Porcelain Strain Insulator - 5½" | 6
8 | Dead End Loop - 30" of ⅜" rod | 6
9 | ⅝" Double Arming Bolts | 3
10 | ⅝"x18" Galv. Machine Bolts | 2
11 | ½"x3½" Galv. Lag Screws | 4
12 | ⅜"x4½" Galv. Machine Bolts | 4
13 | ⅜"x 8" Galv. Machine Bolts | 2
14 | ½"x 8" Galv. Machine Bolts | 6
15 | Dead End Loop - 20" of ⅜" rod | 6
D 80.2




K.P.F. POLE TOP SWITCH MOUNTING
FOR SPANS LESS THAN 180 FT.
CONTINUED
BILL OF MATERIAL
ITEM | DESCRIPTION | AMOUNT
1 | 3 pole K.P.F. Switch complete | 1
2 | Special 6"x6"x10' cross arm | 1
3 | Special ⅜"x1½"x4' braces | 2
4 | ⅝"x 8" Galv. Machine Bolts | 2
5 | ⅝" x 18" Galv. Machine Bolt | 1
6 | ½" x 3½" Galv. Lag Screw | 1
7 | ½" x 8" Galv. Machine Bolts | 6
D 80.4

Standard Grounding. Sheet D 90.1 illustrates the standard method of grounding transformers, lightning arresters or metallic pins at railroad crossings. Clear redwood is used for molding, there being 1½ inches of wood around the conductor at all points, to comply with Statute 499.


STANDARD GROUNDING CONSTRUCTION
Cross Arm Braces
Ground Wire
Strap
Ground Wire Moulding
BILL OF MATERIAL (FOR 40' POLE)
32' Ground Wire Moulding
9 Moulding Straps
18 No.13 3/4 Galv. Screws
40' D.B.W.P. Wire *
1 Ground Cone †
* For grounding No.6 and No.4 secondaries use No.6 wire. For larger sizes use No.2 wire.
For grounding 11000 V. arresters use #6 wire. For 2300 V. arresters use No.2 wire.
† Ground to gas or water pipe if same is within 20 feet.
Pour water in hole when tamping around ground cone.
6" or more
D90.1

Lighting Services: The following schedule of overhead services is inserted for linemen and meter setters:

Two Wire Services.

Number of Circuits.	Size of Wire.
1 or 2	10
3 or 4	10
5	8
6 or 7	6
8 or 9	4
10 to 14	2

Three Wire Services.

Number of Circuits.	Size of Wire.
8	10
9 or 10	8
11 to 15	6
16 to 19	4
20 to 29	2
30 to 42	1/0
43 to 50	2/0
51 to 72	4/0

No. 10 wire is used only where the length of service is under 100 ft.; where the length exceeds 100 ft., No. 8 wire is used.

The local electrical ordinance requires that buildings be wired three wire where the number of services used exclusively for lighting exceeds seven.

State Law: The final sheets of Section D contain extracts from the state law on line construction. Only such items as apply directly to the construction of the San Diego company are included and these are much condensed. Because of their accessibility in other form and of their local application they are omitted in this series.

[To be continued.]

REPORT ON INDUCTIVE INTERFERENCE.

(A report of the results and recommendations to the Railroad Commission of California by a joint committee authorized by the Commission to investigate remedies for the inductive interference of power lines with telephone communication. The findings were presented as a paper at the Spokane A. I. E. E. meeting on September 11, and the recommendations form the basis of an order from the Commission.—The Editor.)

Future Work.

The further work necessary in order to secure the information essential as a basis of determining more explicit and effective rules than those herein recommended, is particularly concerned with the subjects of transpositions and residual voltages and currents. In order to cover these subjects in as effective and economical a manner as possible it is thought that the procedure should be along the following lines:

1. Experimental study of transpositions, which includes the determination of:

a—the practical effectiveness of transpositions in both power and communication circuits as a means of reducing induction arising from balanced voltages and currents; involving considerations of different co-ordinated transposition schemes particularly with different lengths of power circuit "barrels."

b—the practical effectiveness of transpositions in communication circuits as a means of reducing inductive interference arising from residual voltages and currents; involving considerations of different systems, particularly different lengths of balanced communication circuit transposition sections.

c—the influence of imperfect electrical balance of communication circuits in impairing the effectiveness of transpositions.

d—the practical effectiveness of transpositions in a power circuit isolated from ground as a means of balancing the electrostatic capacities to earth of the several conductors, and thereby reducing residual voltages and currents; involving considerations of the relative efficiency of different lengths of power circuit barrels.

2. Experimental study of the causes and effects of residuals, including:

a—a comparison of the different types of power system connection and apparatus in common use and their characteristics in respect to the production of residuals, particularly harmonic residuals.

b—means to be employed in limiting residual voltages and currents.

c—a determination of the minimum values of residual voltages and currents which will produce harmful inductive interference.

It is thought that these two studies could progress simultaneously. The work indicated under (1) could best be done on an actual parallel selected to be as uniform and as free from secondary disturbances as possible Some preliminary work has been done along these lines which indicates the best methods of procedure and this should facilitate the carrying out of the investigation.

The study mentioned under (2) consists in part of an investigation of the characteristics and magnitude of residual voltages and currents in typical power systems, both those with grounded neutrals and systems entirely isolated from ground. A part of the study of residuals is logically related to the study of transpositions and could be carried out in connection with the study outlined under (1) and at the same time and place.

In addition to the above the committee has already arranged for the investigation of the two following subjects:

1—a determination of the detrimental effect of extraneous currents on a telephone circuit as a function of the frequency, including a determination of the maximum amount of extraneous current, of different frequencies and combinations of frequencies, whch is allowable in a commercial telephone circuit.

2—a determination of the effects of extraneous current of different amounts and characteristics in limiting the speed of telegraph operation.

This work is now in progress.

Appendix I. . Harmonics.

Any complex electrical wave of periodic structure may be resolved into component sine waves of suitable amplitudes and phase differences, having frequencies which are in integral relation to the fundamental frequency. The simple sine wave of lowest frequency is termed the fundamental, and those of higher frequency are termed harmonics of the fundamental wave. The fundamental may be considered the first harmonic. The analysis of a periodic wave into its constituent sine waves or harmonics is not merely a mathematical conception or process but is in accordance with the facts of electricity and acoustics.

In general, alternating current systems, by virtue of their inherent characteristics, do not permit the existence of harmonics other than odd integral multiples of the fundamental frequency, i. e., 3d, 5th, 7th, 9th, 11th, etc., harmonics. Such harmonics may exist in either or both the current and voltage waves of a power system.

Commercial frequencies of power transmission in California are 25, 50 and 60 cycles per second. The power systems, so far investigated, operate at a fundamental frequency of 60 cycles per second. The investigation has shown harmonic currents and voltages of appreciable magnitude up to the 35th harmonic. On one system the 23d (corresponding to a frequency of 1380 cycles per second) has been found to be prominent. Induced currents and voltages in parallel communication circuits have been observed corresponding to these harmonics.

The detrimental effect of the induced voltages and currents in parallel communication circuits depends, in general, upon their magnitude and upon the frequency of the induction as compared with the operating frequency of the communication circuit. The presence of extraneous current of a frequency approaching that of normal operating frequency of the communication circuit has a more injurious effect than the same amount of current of a frequency far removed from the operating frequency of the circuit.

The frequency of the voice currents flowing in a telephone circuit ranges from about 200 cycles per second up to possibly 2000 cycles per second. The average voice frequency is considered to be approximately 800 cycles per second, and at about this frequency the telephone receiver is most sensitive. It is on account of these considerations that extraneous currents of the higher frequencies, arising from the harmonics of a power system, are relatively more detrimental to telephone service. The harmonics of the power systems have been found to be responsible for the greater portion of the inductive interference to telephone service, under normal operating conditions of parallel power circuits. Any extraneous current of a frequency within the audible range produces a disturbance which impairs the efficiency of a telephone circuit. The combined effects of all extraneous currents present, of frequencies within the range of audition, constitute the humming "noise" heard in the receiver of a telephone circuit which is subject to induction.

The effect of currents of the fundamental frequency (60 cycles or less) on telephone circuits is relatively unimportant as compared to that of higher harmonics owing to the fact that the fundamental approaches the lower limit of audible frequencies. However, if the induction due to the fundamental becomes sufficiently great, constituting a physical hazard, or of such magnitude as to operate the protective devices on the telephone circuits or interfere with superimposed telegraph service or other grounded signaling devices, it is then of great importance from the standpoint of interference.

In regard to the effect of extraneous currents on the operation of telegraph circuits, for reasons analogous to those given above, such circuits are relatively more affected by extraneous currents of fundamental frequency or of the frequencies corresponding to the lower harmonics such as the 3d and 5th.

At the present time the American Telephone & Telegraph Company is undertaking, on behalf of the Joint Committee on Inductive Interference, an extensive series of tests in regard to the detrimental effect of extraneous currents of various frequencies on the intelligibility of telephone conversation. In addition, this company, in conjunction with the Western Union Telegraph Company and the Postal Telegraph Cable Company, is undertaking an investigation of the effect of extraneous currents on the operation of telegraph circuits and apparatus of different types.

Harmonic currents and voltages in power circuits arise from many causes. Generators or other rotating machines do not, in general, produce pure sine waves of fundamental frequency. This is due to several features in the design of the apparatus. A certain amount of distortion of wave form, with the consequent introduction of disturbing harmonics, is inherent with the use of transformers. This distortion of wave form is due to hysteretic action in the iron core of the transformer. The distortion varies in character and magnitude with the saturation and characteristics of the iron employed. Certain connections of transformers are possible which will suppress the third harmonic and its multiple in a three-phase power system. The fact that practically all inductive interference to telephone circuits is due to the harmonic currents and voltages, renders it important that an effort be made to obtain rotating machinery for use in power systems which produces as nearly as is reasonably possible pure sine waves of fundamental frequency, and also that an effort be made to obtain transformers and to arrange connections of the same in such a manner as to reduce as far as practicable the distortion of wave form.

Electric lamps for oil well use is the subject of a technical paper from the U. S. Bureau of Mines which recognizes the greater safety of incandescent lamps over any form of open flame for lighting gaseous places. Certain precautions are needed to prevent bulbs breaking and allow glowing filaments to ignite explosive gases. Tests show tungsten filament lamps are more dangerous than carbon filament, the conclusion being that the best incandescent lamp to use for lighting gaseous places is the 8 candlepower, 220 volt, carbon filament lamp, and that the safety of this lamp can be largely increased by using bulbs that are constructed without a tip. The electric wiring used in connection with the lighting of gaseous places should, within the limits of the region made dangerous by the presence of gas, be carried in iron-pipe conduit, and the fittings, such as switches, sockets, and junction boxes, should be made to correspond. If it is necessary to install the switches where gas is liable to be present, the switch boxes should be made gas tight. Additional safeguards around lamp bulbs, such as heavy glass outer globes and metallic guards outside the outer globes, provide a factor of safety that is highly desirable.

A KEY TO THE INDEX OF ELECTRICAL DEFICIENCIES, AS URGED BY THE UNDERWRITERS' EQUITABLE RATING BUREAU, PORTLAND, ORE.

BY F. D. WEBER.

[Concluded.]

Wire:

490—Wires of opposite polarity in contact (a) or too close together.

See Code Rule; Inside work 20 (d), 26 (h), (j), (r), 44 (c); Outside work 12 (b), 13 (c), (d).

491—Service discontinued, but live wires still attached to building.

Should be removed.

492—Wires not bushed at entrance.

See Code Rule 12 (f), 85 (e).

49v—Wires against or too close to grounded pipes, or improperly protected.

See Code Rule 16 (e).

494—Wires not protected where liable to mechanical injury.

See Code Rule 20 (e), 26 (e).

495—Wires in contact with outside awning (a) or with metal front or side of building, (b) with metal ceiling.

Iron conduit must be used to protect wires where same come in contact with awnings, metal fronts or side of buildings. See Code Rule 12 (d).

496—Telephone or signal wires in contact with (a) or too close to light or power wires.

See Code Rule 16 (e).

497—Wires not bushed (a) or bushed improperly through walls, floor or partitions.

See Code Rule 16 (d).

498—Wires of opposite polarity through one hole.

Wires must be spaced according to Deficiency 490.

499—Wires too small current carried.

See Code Rule 18.

500—Wires not attached rigidly in position (a) or loose from support.

Wires must be held rigidly by all fittings; See Code Rule 26 (g).

495 (b)—With metal ceiling.

Must be insulated from the metal ceiling by porcelain knobs, cleats or wooden moulding on wooden backing or placed inside of rigid or flexible iron conduit or metal moulding.

501—Other than rubber covered wire used for concealed work.

See Code Rule 26 (n), 26 (q).

502—Wires not properly separated on concealed work.

See Deficiency 490.

503—Wires not supported at sufficiently frequent intervals.

See Code Rule; For open work 26 (h), i, j; For concealed "knob and tube work" see Code Rule; 26r High Potential Systems, Code; Rule 44 (c); Outside work, Code Rule 12 (d).

504—Solid wires used at conductors to swinging or movable lamps.

Series arc lamps; See Code Rule 21 (e); In damp places see Code Rule 21 (b). If stranded wires are used, they will be broken off if they are bent frequently.

505—Wires not entering conduit properly at change from knob and tube to conduit work.

See Code Rule 59 (l), 28 (d), (e), 27 (e), 26 (t); See Fittings under heading Conduit Boxes," "Conduit" outlet bushings, couplings and fittings.

506—No fuse used where change is made in size of wire.

See Code Rule 23 (b).

507—Service wires in bad shape or not properly attached to or insulated from building.

See Code Rule 12.

508—Wires in contact with other materials than insulators.

Wires must be supported on porcelain knobs or cleats or placed inside of wooden or metal moulding approved iron conduit, approved flexible tubing, or approved metal armored cable.

509—Unapproved wire.

See Code Rules.

Wire:	
Aluminum	18 (a)
Armored (See Armored Cable)	
Concentric	56 (c)
Conduit	56
Construction of, general rules	49
Fixture	55
Flexible cord (See Flexible Cord)	
Lead covered	50 (j)
Netting on Arc Lamps	21 (c), 33 (c)
Rubber-covered	50
Slow burning	52
Slow-burning, use of in dry places	26 (g)
Slow-burning, weatherproof	51
Weatherproof	53

See Fittings under heading "Wire."

511—Overfused wire.

See Code Rules 8 (b), 18, 23 (d) and (e); See Motor Data Book for Motors.

512—Wires not properly supported over roofs.

See Code Rule 12 (c).

513—Wires in open work not properly spaced.

See Code Rule 26 (g), to (p).

514—Wires held in place by the wires on sizes smaller than No. 8 B. & S. gage.

See Code Rule 16 (b).

515—Bare wire.

See Code Rules 26 (g), (l), (k), (n), (q), (v); 49 to 57 incl.; See Fittings under heading "Wires." The only place where the N. E. C. sanctions bare wire is for "Trolley" service.

516—Wires knobbed (a) or cleated over horizontal surfaces.

It is impossible to maintain open "knob and tube" wiring over flat horizontal surfaces therefore, this Bureau requires moulding conduit or armored cable work.

517—Dead circuits and wires should be removed.

This Bureau requires the removal of all dead circuits and wires which are in a non-standard condition when a building is rewired as irresponsible parties may connect same to the approved portion of system. Also the dead circuits and wires are many times interwoven with the standard portion making the whole system non-standard, and hazardous.

518—Cleated (a) or knobbed over grounded surfaces.

This Bureau requires the use of a "backing" of wood to fasten knobs or cleats in position when wiring is installed over grounded surfaces.

519—Wires inside of cabinets should be neatly cabled.

Wires inside of all cabinets must be neatly cabled in order to keep them in place.

520—Wires must enter cabinet through openings made for that purpose only.

The practice of bringing wires into cabinets through all manner of openings, is not sanctioned by the Bureau. See Code Rule 26; See Fittings under heading "Conduit outlet bushings and bushings."

521—Wires should be kept free of dust accumulations in sawmills, feed mills and similar places.

Accumulations of dust, rubbish, etc., should be cleaned off open wiring in order to keep it from becoming in a hazardous condition.

522—Two wires on one single-wire knob or cleat.

It is impossible to get the proper distance between wires when two or more wires are placed on one single-wire cleat or knob; See Deficiency 490 and 513.

523—Wires run without insulating supports such as knobs, cleats or tubes.

See Code Rules 16 (d), 26 (h), (j).

Wireless Telegraph.

600—Not properly installed according to requirements of National Electrical Code.

See Code Rule 86.

524—Duplex rubber covered wire (a) single conductor rubber covered wire (b) weatherproof wire, (c) slow burning wire (d) lamp cord, (e) reinforced cord (f) stage cable (g) border light cable (h) packing house cord (i), fixture wire (j), armored reinforced cord, installed in an unapproved manner; (k) Brewery cord. Each of these different types of wire are manufactured for a special purpose or use and must be used for these specific purposes only—as their construction being designed for specific purposes may introduce a hazardous condition when not properly used.

See Code Rule 26(d); See Code Rule 56. This to be used only in iron conduit systems. (a) See Code Rule 26 (g), (k), (q), must not be used for pendant lights or for connections to portable apparatus; (b) See Code Rule 53. See Code Rule 12 and 26 (i) and (j); (c) See Code Rule 52, See Code Rule 26 (g) and (h); (d) See Code Rule 54, See Code Rule 32, must not be used on insulators, in conduit or through porcelain bushings or in moulding (wood or metal); (e) See Code Rule 54, See Code Rule 32 (d); (f) See Code Rule 54, See Code Rule 38; (g) See Code Rule 54, See Code Rule 38; (h) See Code Rule 54, See Code Rule 31 (b); (i) See Code Rule 55, See Code Rule 26 (v) and (y); (j) See Code Rule 57, See Code Rule 32 (e), See Code Rule 54; (k) See Code Rule 54, See Code Rule 31 (b).

Miscellaneous:

700—Inspector was refused permission to enter risk.

This is self explanatory. This attitude of owners and tenants handicaps the inspection department many times. Jeagrivated cases causes the Bureau to resort to making a charge in the insurance rate.

A. I. E. E. AND N. W. E. L. & P. A. CONVENTION.

The joint parallel sessions of the annual convention of the Northwest Electric Light & Power Association and the Pacific Coast convention of the American Institute of Electrical Engineers was held at the new Davenport Hotel in Spokane, Wash., September 9, 10, 11, 1914. The meetings of both organizations were well attended and the papers interesting and provoking spirited discussion. Particular credit is due to the Washington Water Power Company for their capable handling of the arrangements and hearty thanks were extended for their bounteous hospitality.

The Institute meeting was honored by the presence of President Paul M. Lincoln and Hon. Sect. Ralph W. Pope. It was decided to hold the next convention at San Francisco, probably as a part of the regular annual convention of the A. I. E. E. Prof. Harris J. Ryan was indorsed as the choice for the next vice-president, with J. B. Fisken as the alternate.

Banquet at Joint Convention.

O. B. Coldwell, general superintendent of the Portland Railway, Light & Power Company, was elected president of the Northwest Electric Light & Power Association for the ensuing year: E. G. Robinson of Arlington, Washington, vice-president for Washington; Attilla Norman of Eugene, Oregon, vice-president for Oregon, and Robt. A. Foster of Lewiston, vice-president for Idaho. The executive committee comprises N. W. Brockett of Seattle, president; W. J. Grambs, Seattle, Arthur Gunn, Wenatchee, P. A. Bertrand, Aberdeen, L. B. Faulkner of Olympia and H. L. Bleecker of Spokane. E. A. West, efficiency engineer for the Portland Railway, Light & Power Company, was appointed secretary.

Joint Sessions.

The joint session convened at 10:15 Wednesday morning, with H. L. Bleecker, president of the N. W. Electric Light & Power Association, in the chair. Mr. Bleecker introduced W. J. Hindley, Mayor of Spokane, who welcomed the delegates to the "city of light and power" in well chosen words. His speech was marked by a wide understanding of the efforts of electrical men to supply utility service and was characteristically just in its appreciation of the work that they are accomplishing.

N. W. Brockett, secretary of the Association, responded to Mayor Hindley's address in appropriate words of thanks. The two organizations then went into separate session, as is reported hereafter.

A joint session was again held on Wednesday afternoon, when the Hon. W. W. Cotton gave a clear forecast of the future and the pitfalls that the electric companies should seek to avoid by profiting from the experience of the railroad companies. The subject of his address was **"Rates and Physical Valuation of Public Utilities,"** a summary of which appears on the editorial page of this issue.

"Outdoor Substations" was read by the author, J. C. Martin. A brief abstract follows:

The outdoor substation has been evolved to meet the demand for a type of construction in serving rural districts which will at once be reliable, efficient and low in cost. These substations have capacities as low as 25 k.v.a. and voltages at least as high as 66,000. The main factors considered are transformers, protective devices (such as fused air-brake switches), control apparatus and supporting structures. A number of examples are given of construction along the lines of the Pacific Power & Light Company.

The discussion was opened by H. V. Grieser, who described the practice of the Washington Water Power Company in the design and operation of outdoor substations. President Lincoln inquired as to the success of the air-brake switch and fuses in high tension operation. J. Harisberger, F. B. Fisken, O. B. Coldwell, L. T. Merwin, M. H. Gerry and F. D. Nims stated that they were being satisfactorily used on their systems. J. C. Martin closed the discussion by stating that he did not approve the use of secondary or low tension fuses, but would use a low tension circuit breaker. He also reiterated his experience in the satisfactory use of oil which has been shipped in the tanks of high tension transformers.

"Electric Power Development on the Pacific Coast," the last paper at the joint conference, was read by W. E. Herring, a summary of which follows:

The increase in water power development on the Pacific Coast has been greater than that in any other section of the United States. New capital is needed to care for new industries. Figures are given of the development in each of the Western States, with detailed account of companies serving the several districts. Before 1910 the operating companies had difficulty in obtaining capacity needed for the demand upon their plants, but since then an over-development, based upon estimates which have not been realized, gave a surplus of at least 40,000 h.p. in the Northwest, the development of an irrigation load alone having prevented a similar

excess in California. On this account the Northwest should prove an attractive field for the establishment of large power-consuming industries desiring electric current at low rates.

O. B. Coldwell opened the discussion by praising the timeliness of this paper. He emphasized the increasing importance of water storage with recent improvement in the load factor of hydroelectric plants. C. S. MacCalla commented on the over-development of water power in the Pacific Northwest. J. C. Ralston emphasized the duty of the engineer in educating legislators with regard to existing conditions. W. E. Herring closed the discussion by reference to the dire need for a wider understanding of the facts before rational legislation can be expected.

Entertainment Features.

All of the many features of the entertainment provided were extended jointly to the members of the two associations. The visiting ladies were the recipients of many courtesies, a series of receptions, teas, theater parties and automobile trips occupying all of the time that the members were attending the meetings. Great credit is due to S. E. Gates, chairman of the entertainment committee, and the other members for the able manner in which every possible detail had been anticipated.

On Wednesday evening a Dutch lunch was held at the Davenport Hotel. On Thursday evening an illustrated lecture on the electrical features of the Panama-Pacific International Exposition was given by A. H. Halloran, who also announced that there was grave doubt as to whether the International Electrical Congress would be held in 1915 because of the European war; and on Friday evening the annual banquet of the two organizations was held.

O. B. Coldwell, newly elected president of the Association, presided as toastmaster at the banquet, which was enlivened by the reading of frequent telegrams. Brief remarks were made by President P. M. Lincoln, R. W. Pope, N. W. Brockett, W. H. Fraser, John B. Fisken and A. H. Halloran.

On Saturday an all-day excursion by automobile was taken to the Little Falls and Long Lake plants of the Washington Water Power Company and the Nine-Mile plant of the Inland System, an enjoyable camp lunch being served at Long Lake. On Sunday a trolley trip was made over a part of the Inland Empire Railway Company's system, lunch being served at Bozanta Tavern, Hayden Lake, and a visit made to the Washington Water Power Company's Post Falls plant.

A Jovian Rejuvenation was held at the Pythian Hall on Saturday night under the direction of Statesman L. F. Austin, who also officiated as Jupiter. The other members of the degree team were:

Neptune	H. K. Stacey	Apollo	J. A. Gorman
Vulcan	H. L. Bargion	Hercules	C. L. Bankson
Mars	M. Sebern	Avrenim	L. N. Rice
Pluto	E. J. Simon	Mercury	H. G. Peirce

Imps: H. J. Billica, A. S. Hall, J. Perry.

A large measure of the success of the rejuvenation was also due to the energy and enthusiasm of L. A. Shorno. Among the several remarkable features was a wrestling match between a bear and certain unfortunates, a well-staged explosion and a supper cooked entirely by electricity.

A. I. E. E. Session.

"Effect of Delta and Star Connections Upon Transformer Wave Forms" was the subject of a paper by Leslie F. Curtis, read by the author. An abstract follows:

The purpose of the paper is to show the distortions resulting from different symmetrical three-phase connections of generator and transformers without transmission line, as dependent upon the hysteresis cycle and the admittance of the transformers at no-load.

Tests were made with the oscillograph to show the no-load exciting current and voltage waves of three single-phase step-up transformers when the windings of the generator and both sides of the transformers were connected in all possible symmetrical delta and star relations.

Tests are divided into four groups, according to the connection of the generator. In all cases normal low-tension line voltage was held, but voltage and current measurements were considered less important than the recording of wave forms.

Oscillograms are given in each case and the relations between the flux, voltage, exciting current and the hysteresis cycle are shown in two instances.

The author points out that the best voltage wave forms will, in general, be obtained with a star-connected generator and delta-star or star-delta connected transformers.

The discussion was opened by President P. M. Lincoln, who illustrated the effects of the third harmonic by means of the equilateral triangle diagram and neutral points. A. A. Miller commented upon the ease and accuracy with which such subjects are now diagnosed by means of the oscillograph. M. H. Gerry spoke of the value of these results in directing practical work. L. T. Merwin asked for a recommendation as to the best connection for the protection of transmission lines beyond the power house against insulation breakdown. L. P. Ferris illustrated the connections of an air core inductance coil in series with an oscillograph as used by the Committee on Inductive Interference.

"150,000 Volt Transmission" was read by the author, Edward Woodbury. An abstract follows:

The paper describes operating conditions on the 150,000 volt transmission line of the Pacific Light & Power Corporation which delivers power from the Big Creek hydroelectric development to Los Angeles, Cal., 240 miles away. In daily operation 60,000 kw. are generated, utilizing a total hydraulic head of 4000 ft., in two steps. Plans for the future contemplate the building of two more power houses, operating under somewhat lower heads.

Of particular interest is the complete success of the constant potential system, i. e., operation at the same voltage at the genrating and receiving stations, by means of synchronous condensers at the receiving end, in conjunction with automatic voltage regulators, one for each condenser as well as for the generators at each of the power houses. The line has been operated with unusual freedom from short circuits.

Appendixes describe the development of the system, and give data relating to the equipment of the Big Creek transmission line.

J. Harisberger opened the discussion by requesting information as to the need for synchronous condensers. J. B. Fisken inquired if it would be possible to cut out the synchronous condensers from 6 a. m. to 8 p. m., and also asked whether a resistance or reactance was used in the ground connection. Mr. Woodbury later replied that synchronous condensers hold

the voltage at the receiving end practically constant regardless of load and power factor. It happens that they are needed most between 6 a. m. and 8. p. m. W. H. Fraser asked whether steam turbo-generators could be used as synchronous condensers by disconnecting the steam end from the electric and running the generator idle on the line.

A. A. Miller inquired how frequently the 100-mile section of the line is grounded when repairs are being made. Interesting reminiscences on early conditions were given by M. H. Gerry and P. N. Nunn.

"Distribution System for Power Purposes" was read by the author, Mr. F. D. Nims. An abstract follows:

The paper describes the distribution system of the Western Canada Power Company, Limited, touching on the overhead and underground systems in general. It describes the advantages obtained by duplicating lines, both for eliminating outages and from a financial standpoint. Mention is made of the advantages obtained by using a steel-taped lead-armored cable placed directly in the ground, figures showing the exact cost of such an installation being given.

President Lincoln stated that he considered the use of armor cable the most important point developed in the paper, and asked if there were difficulty in locating faults and also remarked upon the trouble with heat from cables in duct. C. S. MacCalla cited his experience with electrolysis of armored cable laid in the ground at Sydney, Australia. Prof. H. V. Carpenter explained how he located faults by means of a telephone and coil of wire. Mr. Lincoln stated that his experience with this method had caused him to abandon it in favor of the Murray loop method. Mr. Nims stated that four cables to a trench was the maximum in his work, much of it being single cable. A megger was used in preference to the telephone method of locating faults. In conformity to the British Columbia regulations wood duct and cable are laid in concrete at railway crossings. He had experienced less trouble from electrolysis with a steel-armored lead sheath cable with jute between the armor and the sheath than with a lead-covered cable subject to the same conditions.

"Electricity in Lumber Industry" was read in abstract by the author, E. F. Whitney. The paper may be summarized as follows:

The development in the application of electric drive to the lumber industry has been exceptionally rapid. Successful sawmill companies are now even operating entirely from central station service, notwithstanding the large amounts of refuse available for fuel.

The paper considers the lumbering industry as carried on in Washington and Oregon, and describes the application of electric power to the various operations carried on under the two main divisions of logging and milling. Typical applications are described, to illustrate types of motors and power transmission equipments, and the average power demands of the various logging operations and milling processes. In addition to the machines used in ordinary sawmill work, those used in planing mills and shingle mills are described. The question of the disposition of waste is considered, and comparative fuel values are given. The illustrations show logging operations and electrically driven saws, finishing machinery and lumber-handling machinery in the Pacific Coast lumber districts.

Discussion was opened by R. F. Monges, who emphasized the importance of the lumbering industry as a likely consumer of hydroelectric power and also the assistance that electricity is giving the lumbermen.

A. A. Miller spoke of the recent change in the attitude of the mill man and the increasing application of electric drive. F. D. Weber told of practical experience with electric mill drive.

L. T. Merwin stated that the peak load in mill work should soon be overcome and inquired if flywheel storage of energy had yet been applied to regulate the power demand.

M. E. Cheney inquired if briquetting of sawdust had proven practicable in preventing this source of material waste.

Attilla Norman stated that the load factor of the Booth-Kelley Lumber Company's new electrified mill is about 50 per cent. He believes that, generally speaking, a saw mill load will not be profitable to a central station.

W. H. Fraser stated that a British Columbia mill served with 750 to 1000 h.p. by a 9-mile 11,000-volt line had not caused serious voltage fluctuation to the town of Blaine, which is served by the same line.

J. Harisberger was optimistic as to the possibility of central station power service for mill work, both from the standpoint of cost to the consumer and of profit to the central station. He cited a mill having a 30 per cent load factor.

E. F. Whitney closed discussion by stating his belief in the future of mill electrification. Electrical logging requires good voltage regulation at the motor terminals and ample copper must be provided in the feeders, which are generally armored cable. The squirrel cage motor, which is usually employed in this service has a low fire risk. Slip-ring motors should be of the inclosed type. The average demand factor is about 70 per cent of the connected load and the load factor about 70 per cent of the demand factor. One mill showed a demand factor of 83 per cent and a load factor of 57 per cent with a connected load of 1550 h.p. The difficulty in getting a higher load factor is largely due to the light loading, for most of the time, of large motors driving head saws, edgers and other machines taking 200 h.p. and more. Load equalizers have met with indifferent success because of irregularity in load variations. The high cost of fly wheel regulators would not meet the approval of mill owners.

"Electrification of Butte, Anaconda & Pacific Railway" was read by the author, J. B. Cox, giving details of the construction and operation of this recently completed 1200 volt d.c. railway. This paper will be printed in full in an early issue of this journal.

Paul Lebenbaum opened the discussion by stating that the Portland, Eugene & Eastern Railway of Oregon operates an electric passenger service of 45,000 train miles per month, with steam service for freight, as yet. Pantograph rollers give a service of about 75,000 miles per roller, collecting from 100 to 150 amperes at 1500 volts.

J. B. Cox stated that the Butte, Anaconda & Pacific obtains 10,000 miles per roller collecting 600 amperes, there being two rollers to each locomotive. About 10 per cent of the mileage of this road is passenger service.

C. P. Kahler discussed Mr. Cox's statement as to the savings effected by electric operation.

Mr. Cox described the electric "tractors" ordered from the General Electric Company for freight service

as a suitable truck equipped with 1200 volt motors of the same size and speed as those on the locomotives. Each tractor is provided with weather protective housing but no cab or pantograph collectors. One tractor trails behind its locomotive as a tender behind a steam locomotive. On series points of the controller all six motors of the combined units are in series, and on multiple positions three motors are in series and the two sets in multiple.

"Application of Electric Motors to Gold Dredges" was read by G. B. Rosenblatt, the author, a brief summary of its salient features following:

Electric power has been applied almost universally to the operation of gold dredges of late, owing to its convenience and to the fact that hydroelectric power is available at very reasonable rates throughout the western states where gold dredging is carried on. There are a number of different motor applications on the elevator type of gold dredge, which is the type most generally used, and the author considers very fully the requirements of the various drives and the characteristics of the motors suited to the various operations of these dredges. Alternating current motors are generally used for these purposes and the type of control, which is of special importance, is considered. The paper also gives some figures on the cost of operation of dredges of different capacities.

M. H. Gerry stated that the real difficuty in applying electric motors to dredge service lies in an understanding of the conditions to be met. He spoke of the heavy construction necessary to give proper strength of many parts. He approved the use of liquid rheostats for large dredges, though grid resistances are satisfactory for smaller dredges. Messrs. Ross and Armstrong discussed the paper from a mining standpoint and R. A. Pope presented a contributed discussion from Ford W. Harris. Contributed discussion was also received from W. M. Shepard. A. A. Miller called attention to the increasing use of electric drive for gold dredging at Dawson.

G. B. Rosenblatt in closing the discussion agreed with Mr. Harris that d.c. motors are ideal for dredge service, excepting for the cost of converting a.c. The subject must be considered more from the mining than the electrical standpoint.

"Economy in the Operation of 55,000 Volt Insulators" was read by J. Harisberger in the absence of M. T. Crawford, the author. An abstract follows:

The author gives a brief outline of the operating experiences on three 55,000 volt lines, two of which have been in service 10 years and one 5 years. The quality of the more modern porcelain insulators is notably superior to those first installed on these lines. A device is described by means of which defective insulators can be readily detected in the very early stages of deterioration, and by periodic use of this device and replacement of insulators, failures in service have been practically eliminated.

The paper was discussed by V. H. Grieser, M. H. Gerry, A. A. Miller, H. R. Noack, L. T. Merwin, L. J. Corbett, R. M. Pope, M. Ross, W. H. Fraser and Ed. Woodbury, the concensus of opinion being that porcelain is inert material not subject to aging. Standard specifications for "a perfect porcelain" are not available.

"Report on Induction Interference" by the joint committee to the Railroad Commission of the State of California, was read by L. P. Ferris, assistant engineer in charge. This paper is now appearing serially in this journal, and as can be noted comprises a series of recommendations as to means of minimizing inductive interference to telephone lines from power circuits.

The discussion was opened by P. N. Nunn who in no uncertain terms voiced the feeling of the power companies that this report is vicious and unjust. A more extended summary of Mr. Nunn's views appear on the editorial page of this issue.

J. B. Fisken brought forth several absurdities which would result in the practical application of the provisions of this measure. A. H. Halloran suggested that the power companies had frequently been an aggressor, that the telephone companies had spent thousands of dollars in vainly trying to devise physical protection and that their plight was worthy of fair consideration.

A communicated discussion was read from A. J. Bowie, who showed that the prohibition of the air-break switch would greatly increase costs to the power companies. He also presented facts and oscillographs tending to prove that air-break switches caused less severe disturbances than oil switches. He concluded with a request that more experiments should be undertaken so that this prohibition might be based upon something more substantial than a "commonly recognized fact."

Geo. S. Humphrey quoted the action of the N. E. L. A. at their recent convention whereby the provisions as to overhead crossings had practically been abrogated. J. C. Martin questioned the 5000 volt limitation in view of the operation of many 6600 volt distributing lines which are not known to be causing trouble. L. J. Corbett believed that a better term than "residual" could have been employed. L. T. Merwin characterized the paper as an insult to the power companies and demonstrated how he had eliminated all trouble on telephone lines by neutralizing the effects of power circuits by means of reactances and condensers at the telephone instrument, which was equipped with a high power transmitter.

L. P. Ferris, in closing the discussion made no attempt to defend the report against the caustic criticism which it had received and merely discussed the meaning of some of the definitions.

President Lincoln then announced the adjournment of the Pacific Coast meeting of the American Institute of Electrical Engineers.

Space forbids a full report on the papers and discussions of the meeting of the Northwest Electric Light & Power Association, but these will be published in early issues of this journal.

Chinese electric light plants are increasing in number. A local Hong Kong electrical firm has obtained the contract for supplying the machinery for an electric light plant at Kongmun, Kwangtung Province, which will cost about $5200 gold. The engines are of Swedish manufacture and the other parts are German. The monopoly for furnishing electric current at Kongmun will soon expire, and the new company will take over this monopoly as soon as its plant is ready. The same Hong Kong company has already furnished the equipment for plants at San Choung, Sunning district, and also at Sunning City, the former costing about $4200 gold and the latter $7250 gold. The cost of erecting a building of the kind required is about $400 gold.

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The Balance of Power

The report on inductive-interference-now appearing in these columns essentially constitutes a number of recommendations whereby power companies may be able to keep a proper balance of power in circuits paralleling telephone wires. Viewed as a scientific study of physical conditions it is a document of great worth. But viewed from the standpoint of an operating power company it seems to throw the balance of power so strongly in favor of the telephone company that there promises to be a lively war in order to effect a readjustment.

The standpoint of the power company was shown in merciless style by R. N. Nunn, chief engineer of the Telluride Power Company, in the course of the discussion which this report provoked when presented at the Spokane meeting of the American Institute of Electrical Engineers. Mr. Nunn charged that what purports to be a mutual study and action for the general good is a box subtly designed to trap the power companies, with the back door open for the telephone company to get in and out at will. His cutting analysis and caustic comment on each requirement demonstrated that the burden of correction is laid upon the power companies. He claimed that some of the provisions involved such a great expense as to practically prohibit operation in many cases. By innuendo and direct accusation he charged the organized telephone interests with having "put this over" on the individual power companies. He prophesied that what has been a local question in California will become a national controversy and in vigorous language he denounced it as a "Bell scheme" opposed to the power industries of the country.

Other participants in the discussion were no less scathing in their denunciation of the report, particularly as its recommendations have been adopted as a general order by the Railroad Commission of California, which body has furthermore made them retroactive. Judging from past experience it is presumed that the report will be made the basis for similar orders by the other commissionrs. The power representatives were unanimous in the belief that the regulation will greatly restrict power development.

Unfortunately no member of the committee was present to answer these attacks. The representative of the committee wisely refrained from a rebuttal, leaving the defense to written communications at some later date. The feelings which the recommendations engendered were so bitter that but scant consideration was given to the scientific aspect and to the great value of the investigation in portraying phenomena about which little has been known heretofore.

An unbiased observer cannot but think that the power companies were the original innocent aggressors. The telephone antedates the transmission of power and telephonic as well as telegraphic communication has suffered from inductive interference. Great sums of money have been spent in experiments to devise some sort of protection against this interference but the engineers have met with little success. It

therefore hardly seems just that the power companies be asked to assume most of the responsibility and cost in obviating these difficulties.

Near-Confiscation

Strong confirmation has been given to a suggestion recently advanced in these columns that a rate based upon the cost of service virtually abrogates the artificial effort of public service commissions to supersede destructive competition by means of regulated monopoly.

In the course of an address at the recent joint convention at Spokane W. W. Cotton forecasted the effect of such a method of rate-making upon electric utilities from the results that similar regulations have already brought about for the railroad companies. After tracing the change in sentiment since 1894, when the railroads were regarded as private properties entitled to name a reasonable charge for their services, he showed that thirty-five per cent of the railroads are gradually being confiscated by the present "near-confiscation" method of rate-making.

The measure of rate value is a "fair return." Less is confiscation. A fair return to a new competing company may put its older rival out of business. Thus a reasonable return and no more may eventually result in confiscation. This is graphically illustrated by the results in prescribing the same food rations for several men with different powers of digestion and assimilation. One man may starve to death on what is enough to fatten another. No two utilities can have the same cost, and on this theory a reasonable return on the investment of one may constitute confiscation of the other.

As an alternative to this method Judge Cotton suggests that the reasonableness of the rate be estimated from the standpoint of the person served, that rates be based upon the value of the service rather than its cost. If undue earnings are found to accrue under this method he proposes that the commission draw a draft against the company at the end of the year.

Readers will readily call to mind other remedies which have been proposed to obviate the injustice of a rate based upon the cost of service, a rate which puts a premium on high costs of construction and poor management. Many valuation engineers prefer the theory of "reproduction cost new," which the California Commission frowned upon in the Antioch rate case. In the light of present day efforts for efficiency and scientific management it certainly seems an anachronism to make rates on a basis which encourages inefficiency and high costs.

The great lesson to be drawn from Judge Cotton's remarks is that the electric utilities should profit from the bitter experience of the railroads. They should go before the tribunal of public opinion and present their side of the case before it is too late.. The immediate problem is essentially one of education. It is necessary to inform legislators and commissioners of the facts. The injustice of the past is one of ignorance rather than wilfulness. The danger of the future is that the companies will lose by default.

The Power of Money

We often speak figuratively of the power of money without a full appreciation of the literal aptness of this expression. Adopting the hydraulic analogy, the stream of coin that is poured forth each year from the mints may well be likened to a stream of water fed from the clouds. Both run to waste unless properly conserved and controlled so as to perform useful work. Whether stored in mountain reservoirs or in bank vaults, their energy is but potential until the gates have been opened and these quantities are set in motion by some such force as the attraction of gravitation or of interest. It may seem novel to think of interest as a force, but in the power equation of money it is invaluable. It is much like gravity, in that its effect is greatly accelerated when compounded. Conducted through the proper channels, it is money that keeps the wheels of industry in motion, and so in time money thus becomes power.

Judging from the press despatches of each day, we find the supply of money for current purposes gradually lessening. This is caused by the conservation of gold by each of the warring nations. As Premier Asquith most aptly stated, the last hundred millions might be the deciding factor of this awful conflict. Money is the great power behind the army, and during these depressing times, it is natural that a lack of confidence be shown, even in America's gilt-edged securities. The support of the great investing public has been withdrawn to a certain extent, and the professional buyer is tempted only by the bargain counter. This icy barrier of distrust will remain until melted by the warming rays of renewed confidence. The stored money of the small investors will be withheld. It is difficult to induce a man to put his savings into a proposed hydroelectric development or new manufacturing interest in times such as these, and yet the warning has been given to the American people by the most conservative statesmen and financial men that we must prepare for the harvest. The old adage,—"It is an ill wind that blows nobody any good," is exemplified in the terrible cyclone of devastation that is sweeping the countries of Europe. America at present is calm, but it is the calm before the storm. A great business revival seems to be in the air everywhere.

To supply the demands for South America, Mexico and the Orient, the Pacific Coast is the logical manufacturing base. Now that our merchant marine is an assured fact, raw material will be as accessible to the Coast as it has been to the East. A great mass of foreign craftsmen will be driven from their homes on account of ruined factories, impoverished employers and the general disorganized condition, and will flock to this great land of liberty to find a market for their skill. Are we prepared for them, or will we be prepared for them when the time comes?

PERSONALS

R. L. St. John, electrical contractor, San Diego, spent the week in San Francisco.

F. G. Beck, auditor American Every Ready Company, San Francisco, has returned from his vacation in the Sierras.

Geo. R. Thomson, representing R. J. Davis, sales agent for Century motors, is visiting towns in Central California.

W. I. Otis, electrical manufacturers' representative at San Francisco, is on a business trip throughout the Sacramento Valley.

M. L. Orcott, general manager of the California Glass Works, Los Angeles, was a visitor to San Francisco during the week.

H. L. Strange, general manager Honolulu Gas Company, and secretary Honolulu Ad. Club, is a recent visitor at San Francisco.

A. J. Pahl, manager K. P. F. Electric Company, left for Chicago last Saturday and expects to remain in the East about six weeks.

A. G. Wishon, general manager San Joaquin Light & Power Company, Fresno, California, is spending a few days in San Francisco.

A. H. Griswold, engineer of outside plant for the Pacific Telephone & Telegraph Company, has returned to San Francisco from New York City.

J. O. Corbett, sales representative of the Economy Fuse and Manufacturing Company, Chicago, spent several days during the week in San Francisco.

P. B. Hyde, representative of Thos. A. Edison Company, San Francisco, returned to the city this week after an extended trip through the Southwest.

James F. Rogan, Southern California representative of the Edison Storage Battery Company, at Los Angeles, is spending the week at San Francisco.

Dr. Thomas Addison, Pacific Coast manager General Electric Company, is making a business trip throughout the East and is expected to return in about a month.

Patrick Longon, controller Mt. Whitney Power & Electric Company, Visalia, Cal., is at San Francisco, accompanied by **Fred Hamilton,** Eastern district manager.

H. N. Lauritzen, Pacific Coast manager Holophane Works of the General Electric Company, has returned to San Francisco from a short business trip in Los Angeles.

H. C. Goldrick, Pacific Coast sales manager Kellogg Switchboard & Supply Company at San Francisco, returned from a business trip throughout the Southern part of the State.

T. A. Marshall, formerly with the De Lavel Dairy and Faget Engineering Company, is now chief refrigeration engineer with the American Ever Ready Company in San Francisco.

J. S. Baker, Pacific Coast manager Crocker-Wheeler Company, San Francisco, is making a two weeks' trip in the Northwest, where he will visit Portland, Ore., Seattle, Wash., and Vancouver, Wash.

Herbert C. Law, of the Brookfield Glass Company, New York, spent a portion of the week in San Francisco, leaving for a few days' stay in Los Angeles prior to attending the coming Jobbers' Convention at Del Monte.

E. M. Fraser, consulting engineer of the Van Emon Elevator Company of San Francisco, is at Vancouver, B. C., putting the final touches on a battery of five gearless traction elevators in the Standard Bank Building.

R. F. Oakes, president American Ever Ready Company of San Francisco, left for New York on business, and while in the East will visit the company's plants at Niagara Falls, Fremont, Fostora, New Jersey, and Toronto. He expects to be gone about three months.

L. A. Gain, electrical engineer, for five years associated with the Western Canada Power Company in designing and construction work, is a visitor in San Francisco. Mr. Gain is hopeful of making business connections that will permit him remaining permanently in this vicinity.

Franklin Overbaugh, secretary, and **T. M. Debevoise,** counsel of the Electrical Supply Jobbers' Association, will attend the meeting of the Pacific Coast Electrical Supply Jobbers' Association at Del Monte next week. Advance registration already indicates the success of this meeting.

John Young, dean of the Engineers' School, Hawaii, formerly consulting and constructing engineer with the Westinghouse, Church, Kerr Co., New York, and a past president of the Hawaiian Engineering Association, spent several days in San Francisco, recently, on his homeward trip from the East.

Charles H. Lee, consulting engineer of Los Angeles, has been engaged by the Ground Water Division, Water Resources Branch, U. S. Geological Survey, to carry on comprehensive investigations of ground water supply throughout the Pacific Slope drainage of San Diego county. Mr. Lee will maintain his engineering offices in the Central Building where he will continue his consulting engineering practice.

REGISTRATION AT SPOKANE CONVENTION.

Following is a list of those registering at the meetings of the Northwest Electric Light & Power Association and the Pacific Coast Convention of the American Institute of Electrical Engineers at Spokane, September 9-10-11:

Douglas Allmond, Anacortes.
L. A. Addison, Spokane.
M. K. Akers, Pullman.
L. F. Austin, Spokane.
E. Baughm, No. Yakima.
E. L. Blaine, Spokane.
H. L. Bleecker, Spokane.
F. S. Burroughs, Olympia.
R. C. Bailey, The Dalles.
P. A. Bertrand, Aberdeen.
C. A. Brown, Seattle.
Mrs. C. A. Brown, Seattle.
J. W. Beyer, Spokane.
J. P. Byron, Spokane.
M. J. Bottinelli, Kellogg.
H. P. Burke, Spokane.
M. W. Birkett, Spokane.
Mrs. M. W. Birkett, Spokane.
George A. Boring, Portland.
N. W. Brockett, Seattle.
E. M. Brummer, Spokane.
B. C. Burdick, Portland.
H. J. Billica, Spokane.
Mrs. H. C. Billica, Buffalo, N. Y.
Miss Grace Billica, Buffalo, N. Y.
S. W. Boyles, Spokane.
F. L. Bargion, Spokane.
Mrs. H. L. Bargion, Spokane.
W. L. Chrysler, Wilbur.
J. W. Conluf, Spokane.
H. V. Carpenter, Pullman.
L. J. Corbett, Moscow.
Mrs. L. J. Corbett, Moscow.
V. P. Campbell, Spokane.
C. E. Condit, Portland.
Leslie F. Curtis, Seattle.
O. B. Coldwell, Portland.
T. R. Cornick, Vancouver.
A. U. Carlson, Spokane.
Stanley Corey, Spokane.
Mrs. Stanley Corey, Spokane.
J. J. Curran, Spokane.
Mrs. J. J. Curran, Spokane.
F. V. Cook, Marshfield.
A. M. Chitty, Wenatchee.
Wm. C. Cook, Spokane.
A. B. Cornwell, Spokane.
J. B. Cox, Schenectady.
M. E. Cheney, Seattle.
W. D. Conover, San Francisco.
Elmer Dover, Tacoma.
L. W. Davis, Butte.
R. S. Daniels, Spokane.
Mrs. R. S. Daniels, Spokane.
W. L. Davies, Vancouver.
D. K. Dalzell, Spokane.
J. E. Davidson, Portland.
S. Dowitt, Spokane.
D. F. Dunn, Vancouver.
D. P. Dunn, Chilliwack.
H. L. Eicher, Seattle.
C. H. Fletcher, Vancouver.
Mrs. C. H. Fletcher, Vancouver.
L. P. Ferris, San Francisco.
H. C. Fiske, Spokane.
W. H. Fraser, Vancouver.
Y. P. Foster, Philadelphia.
Miss H. A. Foster, Philadelphia.
T. L. Foster, Philadelphia.
J. G. Finley, Spokane.
Chas. M. Fisher, Spokane.
Mrs. J. B. Fisken, Spokane.
Miss Ruth Fisken, Spokane.
John B. Fisken, Spokane.
Robt. A. Foster, Clarkston.
M. H. Gerry, Jr., Helena.
V. H. Greisser, Spokane.
H. V. Gates, Portland.
S. E. Gates, Spokane.
Henry L. Gray, Seattle.
A. B. Gates, Spokane.
W. J. Grambs, Seattle.
W. C. Giles, Spokane.
H. C. Gram, Everett.
Jay S. Gros, Portland.
Arthur Gunn, Wenatchee.
Robert Gray, Spokane.
J. W. Geary, Spokane.
Dwight F. Henderson, Spokane.
Mrs. D. F. Henderson, Spokane.
G. R. Hall, San Francisco.
A. H. Halloran, San Francisco.
Geo. S. Humphrey, Salt Lake City.
John Harisberger, Seattle.
W. R. Hendrey, Seattle.
J. C. Huffman, Chicago.
R. Dean Hart, Spokane.
G. H. Hoppin, Spokane.
Mrs. G. H. Hoppin, Spokane.
J. W. Hungate, Spokane.
Mrs. J. W. Hungate, Spokane.
T. E. Holsey, Spokane.
M. Hunter, Spokane.
Percival Hall, Spokane.
Mrs. Percival Hall, Spokane
D. S. Hays, Portland.
J. C. Henkle, Portland.
W. E. Herring, Seattle.
W. A. Howcroft, Herrington.
G. Hamilton, Portland.
A. S. Hall, Hood River.
H. C. Haggenmiller, Spokane.
J. R. Ingersoll, Spokane.
F. A. Jeter, Spokane.
H. C. James, Tacoma.
John A. Jennings, Lewiston.
R. E. Jones, Metaline Falls.
Mrs. Wilson Johnston, Spokane.
J. H. Jamison, Spokane.
G. H. Jeat, Portland.
E. F. Keyes, Sunnyside.
Chas. P. Kahler, Salt Lake City.
J. B. Kilmore, Astoria.
J. M. Kincaid, Portland.
A. L. Kearns, Seattle.
R. C. Kennedy, Wenatchee.
C. S. Knowles, Portland.
L. E. Keene, Denver.
Carl C. Long, Grace.
A. Lindsay, Spokane.
P. M. Lincoln, Pittsburg.
R. W. Lindley, Bellingham.
L. A. Lewis, Spokane.
L. C. LaMont, Butte.
Mrs. L. C. LaMont, Butte.
Chas. A. Lund, Spokane.
Paul Lebenbaum, Portland.
C. A. Lemmon, Anaconda.

E. A. Lindsley, Seattle.
R. W. Lindley, Bellingham.
D. Lewis, Pomeroy.
G. D. Longmuir, Pasco.
H. G. Miller, Spokane.
Mrs. H. G. Miller, Spokane.
E. L. Morse, Spokane.
A. A. Miller, Seattle.
Mrs. A. A. Miller, Seattle.
C. W. Miller, Spokane.
R. F. Monges, Portland.
J. C. Martin, Portland.
Mrs. J. C. Martin, Portland.
Ronald Martin, Portland.
H. I. Melvin, Pullman.
R. U. Muffley, Bellingham.
L. T. Merwin, Portland.
C. C. Marsh, Spokane.
N. E. Moore, Coeur d'Alene.
Mrs. C. A. Mason, Spokane.
A. J. Mayham, Spokane.
J. W. Moss, Spokane.
D. W. Marshall, Spokane.
H. A. Mott, Dayton.
C. S. MacCalla, Spokane.
R. B. McElroy, Spokane.
Jas. S. McNair, Spokane.
Mrs. C. L. MacCalla, Spokane.
M. McCain, Spokane.
Lewis A. McArthur, Portland.
D. C. McKissick.
H. R. Noack, San Francisco.
L. R. Norman. Spokane.
Mrs. L. R. Norman, Spokane.
F. D. Nims, Vancouver.
John Nordmark, Nine Mile Falls.
Mrs. N. A. Naylor, Goldendale.
Geo. Nixon, Spokane.
P. N. Nunn, New York City.
P. H. Neuman, Spokane.
Mrs. P. H. Neuman, Spokane.
A. Norman, Eugene.
J. C. Neylor, Goldendale.
M. C. Osborn, Spokane.
Bernhard Olsen, Spokane.
F. B. Olds, Spokane.
Ralph W. Pope, Elizabeth.
L. J. Pospisil, Spokane.
H. E. Plank, Seattle.
J. H. Paget, Vancouver.
Max C. Passler, Spokane.
H. B. Peirce, Spokane.
L. N. Rice, Spokane.
Mrs. F. L. Rohrbach, Spokane.
E. G. Robinson, Arlington.
Mrs. E. J. Robinson, Arlington.
Foster Russell, Spokane.
A. J. Ruel, Sand Point.
V. W. Russell, Spokane.
E. E. Royer, Spokane.
C. D. Raney, Pullman.
G. B. Rosenblatt, Salt Lake City.
A. A. Rohde, Spokane.
F. E. Ryan, Spokane.
Geo. N. Roobu, Sand Point.
W. G. Stearns, Portland.
H. A. Stummel, Spokane.
I. B. Solberg, Spokane.
V. G. Shinkle, Spokane.
E. D. Searing, Portland.
W. K. Stacy, Spokane.
W. C. Sivyer, Spokane.
S. E. H. Smith, Vancouver.
N. H. Silver, Seattle.
H. C. Swann, Spokane.
Mrs. H. C. Swann, Spokane.
I. A. Shorno, Spokane.
Mrs. I. A. Shorno, Spokane.
W. E. Sholl, Wallace.
W. D. Scott, Portland.
A. V. Steel, Spokane.
Wm. F. Sachtieben, Bremmerton.
J. D. Scott, Portland.
L. W. Sherman, Portland.
Bert L. Sivyer, Okanagan Valley.
N. L. Scott, Spokane.
Geo. C. Sawyer, No. Yakima.
J. V. Strange, Prosser.
J. E. Shinn, No. Yakima.
L. M. Shreve, Wenatchee.
L. W. Simpson, Spokane.
H. P. Thomas, Nelson.
Frederic Tappan, Vancouver.
W. H. Trenner, Boise.
S. W. Thompson, Spokane.
R. E. Tompkin, Spokane.
L. P. Tevis, New York.
J. B. Thornton, Raymond.
C. F. Uhden, Spokane.
Geo. W. Uzzell, Spokane.
Fred. D. Weber, Portland.
Mrs. F. D. Weber, Portland.
Edward Woodbury, Los Angeles.
H. B. Waters, Boise.
Carl L. Wernicke, Portland.
E. S. Whitney, Portland.
C. M. Wright, Spokane.
J. M. White, Spokane.
H. S. Wells, Portland.
R. W. Whiffley, Bellingham.
E. A. West, Portland.
Chas. Young, Spokane.

MEETING NOTICES.

Eighth Annual Convention Illuminating Engineering Society, Cleveland, Ohio. September 21 to 26, 1914.

All preparations have been completed for the reception of delegates and guests at the coming convention of the Illuminating Engineering Society to be held in Cleveland, September 21st to 26th. The Hollenden Hotel has been selected as Headquarters where reservations may be made direct by delegates and guests or, should they prefer doing so, requests may be made for reservations through the chairman of the Hotel Committee, Mr. A. G. Summerell, who can be addressed care National Carbon Company, Cleveland, Ohio.

PROGRAM.

Monday, September 21st—Morning Session 10:30 to 12:30.

Opening meeting for ladies and gentlemen. Assembly. Address of Welcome. Response. Presidential Address—C. O. Bond. Report of Committee on Progress. Report of the Committee on Research.

Afternoon Session 2:00 to 5:00.

Color of Illuminants—L. A. Jones. Artificial Daylight: Its Production and Use—M. Luckiesh and F. E. Cady. Development of Daylight Glass—E. J. Brady.

Tuesday, September 22d—Morning Session 9:30 to 12:30.

Relation of Light to the Critical Inspection of Documents—A. S. Osborn. Planning for Daylight and Sunlight in Buildings—L. B. Marks and J. E. Woodwell. Air-Shaft Illumination as Studied by Models—C. H. Sharp.

Evening Lecture Session 8:15 to 10:15 p. m.

Photo Sculpturing and the Use of Light in the Reproduction and Illumination of Sculpture—John Hammond Smith. Color Photography—M. C. Rypinski.

Wednesday, September 23d—Morning Commercial Session 9:30 to 12:30.

The Locomotive Headlight—J. L. Minick. Present Practice in the Use of Tungsten Filament Lamps for the Lighting of Metal Working Plants—A. L. Powell and R. E. Harrington. Factory Lighting. Cost Maintenance and Installation Cost.—O. R. Hogue and A. O. Dickers.

Morning Laboratory Session 9:30 to 12:30.

Light Filters for Use in Photometry—C. E. K. Mees. Experiments with Colored Absorbing Solutions for Use Heterochromatic Photometry—H. E. Ives and E. F. Kingsbury. Characteristic Equations of Tungsten Filament Lamps and Their Application in Heterochromatic Photometry—G. W. Middlekauff and J. F. Skigland. A Transmission and Absorption Photometer for Small Areas (to be read in title)—P. G. Nutting and L. A. Johns.

Afternoon Commercial Session 2:00 to 5:00.

Recent Improvements in Incandescent Gas Lighting—R. F. Pierce. Characteristics of Gas-Filled Lamps—G. M. C. MacKay. The Lighting of Rooms through Translucent Glass Ceilings.

Afternoon Laboratory Session 2:00 to 5:00.

Mixed Specular and Diffuse Reflection—P. G. Nutting. Notes on Integrating Sphere and Arc Lamp Photometry—N. K. Chaney and E. L. Clark. A New Standard Light Source (to be read in title)—L. A. Jones. Some Tests of Possible Reflecting Power Standards (to be read in title)—P. G. Nutting, L. A. Jones and F. A. Elliott.

Thursday, September 24th—Morning Session 9:00 to 12:30.

Some Uses of Light in the Treatment of Disease—E. C. Titus. Some Experiments with the Ferreo Test for Eye Fatigue—J. A. Cravath. Further Experiments on the Efficiency of the Eye Under Different Conditions of the Lighting—C. E. Ferree and G. Rand.

Afternoon or Evening Session 7:30 to 8:30.

The Visibility of Radiation—P. G. Nutting. Some Recent Experiments on Vision in Animals—H. M. Johnson.

The program of entertainment arranged for by the committee of which Mr. C. L. McKinstry acts as chairman, is as follows:

September 21, 1914—Monday Afternoon:

Tea and social afternoon for the ladies at Hollenden Hotel.

Monday Evening:

Formal reception and ball for ladies and gentlemen, Hollenden Hotel.

September 22, 1914—Tuesday Afternoon:

Trip to Women's Clothing Factories for ladies. Lunch at factory.

Tuesday Evening:

Popular lecture at Chamber of Commerce Building for ladies, gentlemen and their friends.

September 23, 1914—Wednesday Afternoon:

Luncheon and Bridge at some Country Club for the ladies.

Wednesday Evening:

Banquet, Hollenden Hotel for ladies and gentlemen.

September 24. 1914—Thursday Afternoon:

Trip to Nela Park, supper and evening entertainment for ladies and gentlemen.

San Francisco Jovians.

A large and enthusiastic meeting of the Jovians was held Tuesday, September 15th. After transaction of the regular routine business, the speaker of the day, Mr. H. H. Cudmore of the Mazda Bureau, was introduced and addressed the gathering on the subject of "Co-operation." It was decided to accept the speaker's offer to conduct a smoker on the evening of Jovian Day in October, details of which are to be announced later. Talks were also made by J. O. Corbett, R. L. St. John and several others.

Engineers' Club of San Francisco.

At the bi-weekly luncheon of the Engineers' Club on September 16, T. W. Ransom, mechanical engineer for the Board of Public Works, gave an interesting address on San Francisco's municipal street railways.

On August 26, 1913, bonds were authorized to the amount of $3,500,000 for the construction of municipal street railways. During the year detailed plans and specifications were prepared and contracts were entered into for the following:

Construction of Van Ness avenue line from Market to North Point street, on Chestnut street from Van Ness avenue to Scott street; thence in Scott street to Greenwich street; thence to Steiner street, where connection was made to the tracks of the Union street line; total length 3.26 miles. This was completed and put in operation August 15, 1914.

Potrero avenue line from Market street, along Eleventh street to Division street, along Division street to Potrero avenue and on Potrero avenue to Twenty-fifth street. This contract was completed September 1, 1914, and was in operation September 7, 1914. Length 1.99 miles.

Union street line.—This line was purchased from the Presidio & Ferries Railroad Company for the value as appraised by the City Engineer, and operation commenced December 11, 1913. Length 3.9.

Stockton street line.—From Market street along Stockton street to Columbus avenue, where connection will be made with the Union street line. The line is now under construction and will be completed about October 10, 1914. Length 0.97 mile.

Masonic avenue extension.—This is an extension to the Geary street line and extends from Geary street to Turk street and was built to facilitate traffic to the new baseball park. Length 0.26 mile.

Plans are being prepared for an extension on Columbus avenue from a connection with the Union street line to North Point street; thence to Van Ness avenue, and thence to Chestnut street to connect with the Van Ness avenue line; also an extension through the Fort Mason Military Reservation to Laguna street at an entrance to the Exposition grounds.

Plans are also in preparation for the construction of the California street line from Thirty-third avenue to Second avenue, thence to Geary street to connect with the Geary street line; also for a line on Church street.

Contracts have been made for 125 street cars and of this number 36 have been delivered by September 1st. Contracts have been let for the enlargement of the Geary street car barn and plans made for a new structure for car storage at Seventeenth, York and Hampshire streets.

On August 10, there had been expended from the Municipal Railways construction fund the sum of $1,070,038.51.

He further detailed the efficient organization whereby this work has been accomplished.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The Washington Public Service Commission will hold an important session in Seattle beginning with September 30, to take up various matters. The first question to be considered will be the Twenty-first street car service. On October 5th the adjustment will have to do with the protest of Phinney avenue residents against "Ballard" designation in the telephone directory; October 6, protest against Seattle-Everett toll rates of Pacific Telephone & Telegraph Company; October 8th, arrangement of transfer exchanges between municipal car line and Seattle, Renton & Southern and Puget Sound Traction, Light & Power Company. On October 20 the commission will sit at Port Townsend to consider complaints against the electric light rates charged by the Key City Light & Power Company, and during the same week will have a hearing at Everett on gas and electric rates.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Western States Gas & Electric Company, operating in San Joaquin, Humboldt, Sacramento, Calaveras, Amador, El Dorado and Contra Costa counties, has filed an application asking permission to create a three-year 6 per cent note issue in the sum of $1,500,000 to be secured by a trust deed of all the company's properties.

The Commission has rendered a decision granting the Lindsay Home Telephone and Telegraph Company of Lindsay, Tulare County, authority to issue a promissory note of the face value of $2000 for a term not exceeding five years.

The Commission has rendered a decision authorizing the Northern California Power Company, Consolidated, to issue $22,000 in promissory notes for the purpose of refunding other notes outstanding.

The Commission has made a supplemental order authorizing the Southern Counties Gas Company of California to execute a mortgage on its property in the form of a deed of trust to the Central Trust Company of Illinois and William T. Abbott of Chicago.

The Snow Mountain Water and Power Company has filed an application with the Commission asking authority to transfer and lease a portion of its property to the California Telephone and Light Company. The latter company requests authority to issue a promissory note amounting to $790.18 in return therefor.

The Commission has rendered a decision extending the time in which the Santa Barbara Gas & Electric Company may issue $100,000 of 6 per cent bonds from August 1, 1914, to December 31, 1914.

The Commission has rendered a decision authorizing the Pacific Gas & Electric Company to issue $1,000,000 of its general and refunding mortgage gold bonds. The company proposes to pledge these bonds to secure its sureties on two bonds which it must file in the District Court of the United States in connection with suits brought to enjoin the enforcement of the gas and electric rates fixed by the Board of Supervisors of San Francisco for the year ending June 30, 1914.

The Contra Costa Gas Company has filed an application with the Commission asking authority to issue twenty shares of its capital stock to S. Waldo Coleman; to issue 591½ shares of capital stock, and to create a bonded indebtedness of $500,000, and to issue $109,000 par value of said bonds.

The Hughson Telephone Company, operating in Hughson, Stanislaus County, has filed an application with the Commission asking authority to issue 5000 shares of common stock at $1.00 per share.

The San Joaquin Light & Power Corporation has filed an application with the Commission asking authority to renew certain promissory notes totaling $44,156.48, for a period not exceeding one year from date of maturity.

TRADE NOTES.

The first Cutler-Hammer electric steering gear in a foreign navy is on the Greek battleship Kilkis. This ship which has been purchased from the United States was formerly the U. S. S. Mississippi. The Kilkis is reported as having arrived safely at Athens.

The Capital Electric Company of Salt Lake City has been awarded the contract for installing the electric conduit and wiring in the new Dee-Eccles Building now in the course of erection. The entire top floor of the building will be devoted to a dance hall 90x120 feet which will be lighted entirely by indirect cove lighting.

A five-year contract was recently made by the Booth-Kelly Lumber Mill at Springfield, Oregon, with the Oregon Power Company for the complete operation of the lumber mill by electric power. The inauguration of electric service at this mill is an epoch in the lumber history of Oregon in that it is the first electrically operated mill in the state.

Evans-Dickson Company, consulting engineers and contractors, Tacoma, are installing a small water power plant for the Montazuma Coal Mines Company at Fairfax, Washington; are doing the electric work in the Oregon-Washington freight sheds at Tacoma and furnishing an electric cooking outfit for the Kapowsin schools at Kapowsin, Washington.

The Capital Electric Company were awarded the contract by the Utah State Capitol Commission for the furnishing and installation of a 100 kilowatt General Electric motor generator set which will be used in supplying direct current service for the operation of the passenger elevators and some other direct current power equipment to be located in the new State Capitol building. This motor generator is made necessary by the fact that the Capitol Building is located so far outside of the Utah Light & Railway Company's direct current distributing system, that it was not advisable to extend their mains to it.

The scarcity of ferro-manganese in America, due to cessation of shipments from continental Europe, has resulted in resumption of activity at the Heroult electric smelter. The company operating the plant, the Noble Electric Steel, owns a vast deposit of high grade manganese a short distance from Heroult, and has proven its ability to produce ferro-manganese with the electric furnace. The first furnace has been, and the second will be blown in within a few days. More units will also be placed in commission. Chronium will also be produced. The company has placed a large force at work in the iron

mines along Pit River, and heavy shipments of crude ore to the plant over the aerial tramway will soon be in order. The company for years has been endeavoring to produce pig iron, but costs have proved so large, coupled with smelting troubles, that several months ago all work was suspended and the company faced a severe loss. The outbreak of war in Europe has changed all this, and the management is convinced that next year will prove a highly profitable one.

NEVADA FIELD MEET.

A field meet between first aid teams from several railroads, mines and power plants was the feature of the Labor Day celebration at Reno, Nevada. This meet was held under the direction of J. G. Scrugham, dean and professor of mechanical engineering at the University of Nevada, who has organized first aid and rescue teams in every industrial establishment of any importance in Nevada.

Teams in Electric Accident Contest.

The mine rescue contest was held between teams from the Tonopah Mining Company, the Nevada Consolidated, the Tonopah Belmont and the Goldfield Consolidated, awards being allotted in the order named.

In the railroad and power plant first aid contests teams were entered by the Southern Pacific Company, Nevada-California-Oregon Railway, Nevada Northern Railway, Virginia & Truckee Railway, Reno Power, Light & Water Company, Truckee River General Electric Company and the University of Nevada Electrical Engineering Department. The problem to be handled was:

Wreck on electric road; man found with right forearm in contact with trolley wire and severely burned; left leg cut off 2 inches above knee; deep cut on back of head; severe bleeding; simple fracture of left wrist; time, 25 minutes.

In the contest the first prize was awarded to the Nevada-California-Oregon Railway; second prize, Southern Pacific Railway; third prize, Virginia & Truckee Railway; fourth prize, Nevada Northern Railway.

The accompanying illustration shows the teams engaged in the contest, reading from left to right: Truckee River General Electric Company, Reno Power, Light & Water Company, Southern Pacific Company, University of Nevada Electrical Engineering Department, University of Nevada Mining Engineering Department, Goldfield Consolidated, McGill Concentrator and Nevada-California-Oregon Railway. The structure shown in the rear is part of model of a mine drift, 250 ft. long in which the mine rescue tests were held.

In the miner's first aid contest the problem was: Miner found in drift under fall of rock in contact with electric wire; rescue patient and restore breathing; patient suffering from following injuries: deep electric burn on small of back; scalp wound and left eye ball cut; severe bleeding; right collar bone fractured and simple fracture of right forearm; compound fracture of right thigh 5 inches from knee; severe bleeding; time, 25 minutes.

The winners in the miners' contest were: First prize, Nevada Consolidated Copper Company (McGill concentrator team), score 100 per cent; second prize, Tonopah Extension; third prize, Tonopah Belmont; fourth prize, West End Consolidated and Goldfield Consolidated, tied.

One of the interesting events of the day was the demonstration made by E. P. Cullinan, chief electrician of the Belmont Development Company of Tonopah, of his method by which one man can carry two unconscious men from a mine, although the burden may be more than twice the weight of the rescuer. To illustrate his method, Mr. Cullinan, who weighs 140 pounds, placed two men on the ground, the first on his stomach and the other in the same position on top of him, with arms extended forward over and beyond the shoulders of the first man. Taking a position at the head of the two men, Mr. Cullinan raised their heads and bodies to an angle of about 45 degrees, then losening his hold he ducked under them as the bodies fell, and caught them on his back. Then securing a lock hold at the knee and arms, he rose with the two men on his back, and in that position was able to carry them a considerable distance. The combined weight of the two men carried was 335 pounds. The method has been named the "Nevada one.man carry" and is a distinct innovation in mine rescue work.

Preceding the program of sports the electrical section of the Nevada Industrial Safety Association gathered in the Mackay School of Mines Building, where several interesting papers were read. These included one by E. P. Cullinan, chief electrician of the Tonopah Belmont mine, describing an electrolytic hoist control. Prof. J. G. Scrugham, of the engineering department of the university, read a paper prepared by himself and A. N. Voss. chief engineer of the Beowawe Locomobile plant, describing that plant. A. G. Jones, of the General Electric Company, read a paper on the use of nitrogen lamps and headlights; and E. M. Cutting, manager of the Edison storage battery department, read a paper on storage batteries.

INDUSTRIAL

NOVEL HYDRO-PNEUMATIC EQUIPMENT.

A novel hydro-pneumatic installation has recently been made by the Snowstorm Mining Company operating in the Coeur d'Alene district, Idaho. The plant consists of a 300 h.p. air compressor, rope driven by a Pelton water wheel and an induction motor direct coupled and working either independently or in parallel with the water wheel unit, when the latter rotates at 347 r.p.m.

Due to the variable water supply available for the wheel and the continuous operation required of the compressor, it was necessary to install a 250 h.p. electric motor to help out during the period that the water wheel was unable, from lack of water, to drive the compressor at the required load and speed.

Current for the motor is secured from a transmission line of a commercial plant supplying the district. Mounted on the electric motor shaft is a 46 in. dia. rope sheave which drives a fourteen foot sheave on the compressor. The compressor sheave is groved for 19-1¼ in. dia. Manila ropes, and the sheave is cast with sufficient weight to permit obtaining the requisite flywheel effect for the compressor's operation. The American system of rope transmission is employed, the tension sheaves and re-winders being placed above the driving ropes and located in such a manner as to conserve floor space and head room to the greatest extent.

The water wheel equipment consists of a twin runner Pelton-Doble tangential water wheel unit, one runner being approximately 44 in. in diameter, and is capable of developing 325 h.p. when running at a speed of 347 r.p.m. This speed also coincides with the full load speed of the induction motor. The other wheel is approximately 72 in. in diameter and develops 250 h.p. at a speed of 212 r.p.m. Both water wheels are keyed on the same shaft, which is extended and coupled to the electric motor shaft, carrying the driving sheave. One or the other wheel must develop the requisite power when running at its correct speed; in this event the idle wheel, the pressure water being shut off from same, simply rotates on the shaft without performing useful work other than providing additional flywheel effect for the installation. Both wheels never develop power at the same time.

The requirements of the plant call for the highest efficiency over a wide range of operating conditions, involving aproximately a 300 per cent fluctuation of the power water supply, and a variation of the compressor speed, hence the power required for same, depending upon the demands on the air line. It is necessary, during certain times, that 300 h.p. be delivered to the compressor sheave when the latter rotates at 95 r.p.m.

If there is sufficient water available the 44 in. Pelton wheel develops this power without assistance from the electric motor. Should the water supply be insufficient, current is applied to the electric motor to supply the deficiency. At other times, and over a period of several hours' duration per day, the compressor output is reduced to an amount corresponding to 58 r.p.m. In this event the water for the 44 in. Pelton wheel is shut off and it rotates idly while the 72 in. Pelton wheel is allowed to develop the power without assistance from the motor. While either wheel may develop its full power when operating at its correct normal speed of 347 r.p.m. for the 44 in. wheel and 212 r.p.m. for the 72 in. wheel, quite a wide variation of speed below normal may be secured, hence a most flexible installation has been secured.

The novelty of this plant consists of the application of a variable speed, variable power tangential water wheel unit to a constant speed induction motor, driving a compressor. The plotted efficiency curves of the water wheels are quite flat for a range of power between 220 and 300 h.p. for the 44 in. wheel when rotating at 347 r.p.m., and for the 72 in. wheel between 160 and 230 h.p. output at 212 r.p.m.

For slight reductions of speeds below normal the efficiency holds up remarkably well, as was predicted. These results are obtainable from the type of ellipsoidal water wheel buckets employed in conjunction with needle regulating nozzles. The latter discharge a perfectly circular, solid jet under variations corresponding to full load of the respective wheels, down to about ten per cent of the maximum load. The hydraulic surfaces of the water wheel buckets are ground and sharpened and the whole water wheel unit especially developed for this particular plant.

To safeguard the water wheels from rupture due to centrifugal force, they are designed to operate under emergency runaway conditions of double the normal speed without stressing the parts beyond their elastic limit. The hydraulic apparatus was designed and constructed in the San Francisco works of The Pelton Water Wheel Company.

A NEW BRYANT SWITCH.

The Bryant Electric Company of Bridgeport, Connecticut, has produced a new snap switch especially for electric ranges and other heating appliances.

Instead of increasing the number of coils or elements in operation by throwing them progressively into circuit, as has been the custom heretofore, this new switch gives greatest heat at first operation. In other words assuming the switch to be in the "off" position, the first twist of the knob throws into circuit all the elements it controls. The second position cuts the heat down to medium, the third to low and the fourth is the "off" position.

In this manner, the degrees of heat are provided in the order in which they are most frequently desired, and a much smaller switch can be used. A feature of this new switch is that the indicating dial, showing whether the switch is "off" or in positions 1, 2 or 3, is set at an angle of 45 degrees so as to be visible from any position in front of or above the switch. Switches are made in the 2½ and 5 kw. sizes.

BOOK REVIEWS.

Electric Motors. By F. B. Crocker and Morton Arendt; 305 pp.; 6x9; cloth. Published by D. Van Nostrand Company, New York City and for sale by Technical Book Shop, San Francisco. Price, $2.50.

The second edition of this standard text contain many additions and revisions which bring the treatment more fully in accord with present day practice. While intended primarily for the use of the student the text is well adapted for study by anyone interested in the operation of motors, as matters of purely theoretical interest have been eliminated.

Walker's Manual of California Securities and Directory of Directors; 1914 edition; 544 pp.; 6x9; compiled by H. D. Walker, 454 Montgomery street, San Francisco. For sale by the author, or by Technical Book Shop, Crossley Building, San Francisco. Price, $4.00.

The sixth annual number of this standard reference work of California investment securities maintains the high standard set in previous issues. The text is made up of nine sections giving respectively the bonded indebtedness of the state and large cities; the banks, the financial statements of the general corporations (including the principal utilities), the sugar corporations, the oil corporations, San Francisco street railway franchises, stock and bond quotations and directory of directors.

NEWS NOTES

INCORPORATIONS.

ORANGE, CAL.—El Modena Domestic Water Company has been organized with H. M. Gray, W. F. Crist, Isaac McCollum, John King and Geo. Wood as directors. The company, which will distribute water at El Modena, is capitalized for $10,000.

FAIRVIEW, MONT.—Articles of incorporation for the Jennison Light & Power Company have been filed with a capital stock of $100,000. The purpose is to erect a power and electric light plant near here. Chas. W. Jennison, Williston, N. D.; Herman O. Frank and Wm. D. Miller, Minneapolis, and Warren J. Jennison, Fairview, are the incorporators.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed by the California Terminal Railway Company with a capital stock of $200,000, the purpose of which is to build a railroad from San Francisco to Sacramento. The new company has been incorporated to take over the interests of the California Terminal Company. C. W. Conlisk is the principal stockholder and W. M. Rank and C. H. Lind are the other incorporators.

TRANSMISSION.

RIVERSIDE, CAL.—The common council has granted permission to the Pacific Electric Railway Company to construct a new transmission line from its substation at Main and First streets, to Colton avenue, the line to run parallel to and 100 feet south of the Southern Pacific tracks.

LOS ANGELES, CAL.—Despite the fact that Superior Judge Hewitt has sustained the demurrer of the city, without leave to amend, in Frank E. Hartigan's suit attacking validity of the $6,500,000 power bonds, Mr. Hartigan it is understood will appeal. The appeal will again delay the sale of the power bonds.

JUNUEAU, A. T.—Speel River Electric Chemical Company and Speel River Power Company, which have obtained a government grant for hydroelectric chemical and power plant on Speel River, 35 miles south of here, expect to start construction work within a few months. E. P. Kennedy, Hotel Washington, Seattle, is interested in the project.

LOS ANGELES, CAL.—The city council has adopted a policy regarding the development of power on Big Pine Creek The resolution sets forth that development of power on Big Pine Creek is a necessary part of the city's plan for developing electrical energy, and it is the purpose of the city to install plants on the stream for such a purpose and connect same with transmission system now being constructed.

VISALIA, CAL.—At a meeting of the directors of the Mt. Whitney Power & Electric Company held a few days ago J. C. Hays was retired from the office of president. The directors present were Mr. Hays, S. Mitchell, C. E. Baker, Ben M. Maddox and P. M. Longan. Mr. Hays has been president of the company for the past seven years, during its greatest period of development and construction. The action taken by the directors is presumed to be a part of a reorganization plan which has been under way for several months past, since the advent here of P. M. Longon, representing the J. H. Hammond interests.

LOS ANGELES, CAL.—Action seeking to cancel the right of way of the Kern River Company over public lands in California has been instituted by the U. S. District Attorney's office at the request of the Attorney General of the United States. The defendant company is a subsidiary of the Pacific Light & Power Corporation. The complaint filed would affect property, chiefly canals, valued at several millions within the Sequoia national forest. It is based on the alleged fact that the right of way grant given by the interior department was approved upon a showing that it was wanted for public use, while in fact the corporation was already under contract to use practically all of the water for power generation.

FALL RIVER MILLS, CAL.—Fifteen miles of wire, also a great quantity of insulators, have arrived from Bartle, consigned to the California Power & Manufacturing Company. The shipment of materials is sufficient to complete the work of running the electric line from Fall River Mills to McArthur, 4½ miles distant. Poles are set from here to McArthur and from here to Glenburn, the latter being seven miles distant, and the company intends to complete the service to McArthur, and be all in readiness to serve electric power, at least for lighting, to that place by October 1st. The company, whose headquarters are in San Francisco, purchased the electric light plant owned by Florin Bros. in Fall River Mills, in the early part of the summer, but has experienced many drawbacks in the construction work. It is not likely that the whole valley will be served with electricity for all purposes this season, as first seemed possible. However, the farmers hope that the power will be available for irrigaion next season, irrigation being the main object of the development.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The supervisors are in receipt of a communication from City Treasurer McDougald stating that he has disposed of $150,000 worth of Geary street road bonds at 5 per cent to Bond & Goodwin. The premium amounts to $950.89 and the accruing interest to $1916.57, making a total of $15,286.56.

FRESNO, CAL.—The Fresno Interurban Railroad is planning an extension of a mile and a quarter to a point within 400 feet of the Normal School. J. B. Rogers, who is promoting the building of these lines, has made application to the supervisors for a franchise extending from Fresno avenue to the Normal School. Rights of way are now being secured and a portion of the bonus desired has been subscribed. The new line will represent an increased capitalization of about $20,000.

SEATTLE, WASH.—The City Council has agreed with receivers of the Seattle, Renton & Southern Railway to buy the road for $1,600,000, transfer to be made October 1st. The line will be made part of the municipal system already in operation. The Seattle, Renton & Southern Railroad is 12 miles long and extends from the business center of Seattle to the coal mining and manufacturing town of Renton. The purchase of the line would permit the city to connect the northern and southern divisions of its municipal system, which do not now reach the business district. The Renton line has been in litigation for many years. A court decision last month affirmed the validity of its franchise, which the city officials had questioned.

SAN FRANCISCO, CAL.—The supervisors heard various plans for constructing the Municipal Railway on Church street, between Eighteenth and Twenty-second, at a recent meeting. City Engineer O'Shaughnessy maintains that the scheme he first submitted and now known as plan No. 4 is the best. As this plan involved the assessment of property owners in the adjacent district to the extent of $330,000 for opening a new street, protests were filed by them, and for that reason the supervisors last April called for other plans. The city engineer says that the Church street road is to be a main-trunk line of the Municipal Railway. Its terminus at the beginning will be at Thirtieth street, but the intention is to extend it to the Sunnyside district and eventually to the county line. As it will be a main line, it should have no dangerous grades, O'Shaughnessy says, that the

best way to secure proper grades is by cutting a new street along Mission Park from Eighteenth to Twentieth street and through private property from Twentieth to Twenty-second.

SAN FRANCISCO, CAL.—City Engineer O'Shaughnessy states that the construction of the Municipal Railway line on California street will soon be commenced. This road will begin at Geary street and Second avenue, where a connection will be made with the Geary street line, and will run along Second avenue, Cornwall street to Sixth avenue, and California street to Thirty-third avenue. The City Engineer says that the specifications will be ready in two weeks and that the contract can be awarded about the beginning of October, in which month he expects work to begin. He counts on having this line in operation before the end of this year. The Board of Works has agreed to pay the United Railroads $1400 for reconstructing the crossing at Sixth avenue and Cornwall street and installing a crossover for the Municipal Railway. The United Railroads has offered to sell to the city its track and roadbed on California street, between Ninth and Twelfth avenues, for a reasonable price, and the city engineer has the proposition under consideration. The terminus of the California street line will be at Thirty-third avenue for the present, but city officials say that after the road is in operation an arrangement may be made with the United Railroads for running city cars further out over the United Railroads' tracks.

ILLUMINATION.

WHITEFISH, MONT.—Call for bids for the construction of an electric light system here will be issued by the town clerk.

ANDERSON, CAL.—By a vote of 123 to 10 this place has voted to establish a lighting district that is co-extensive with the town.

FLAVEL, ORE.—Request will probably be presented to the Pacific Power & Light Company, Astoria, to furnish lights for this town.

NEWPORT, CAL.—An ordinance has been adopted providing for the issuance and sale of bonds in the sum of $20,000 for the construction of an electric street lighting system.

HOQUIAM, WASH.—L. H. Burnett and associates of Aberdeen, who are incorporating a company to bore for natural gas, have made application for a 50-year gas franchise in this city.

REDLANDS, CAL.—The Edison Electric Company has submitted bids for street lighting and park lighting, the present contract expiring in December. Bids were referred to the street lighting committee.

PLUMMER, IDAHO.—Dunkit Brothers have been granted a certificate of public convenience and necessity by the public service commission of Boise, for the installation of an electric generating plant here.

SACRAMENTO, CAL.—The Westinghouse Electric Company has been granted a contract by the State Board of Control to furnish the state buildings with electric lamps for the ensuing year. The contract amounts to about $10.000.

LOS ANGELES, CAL.—The city electrician has submitted to the board of public works specifications for the proposed ornamental lighting system for Mariposa avenue, between Romaine and Melrose avenue. Actual work will begin shortly.

BERKELEY, CAL.—A resolution of intention has been adopted for lighting with gasoliers the entire length of San Pablo avenue. The plans call in all for 65 lamps and the Pacific Gas & Electric Company will begin their installation at once.

HERMOSA BEACH, CAL.—A petition signed by property owners has been forwarded to the board of county supervisors, requesting that they sanction the establishment of a highway lighting district beginning at Manhattan Beach city limits and extending to the city limits of Hermosa Beach, a distance of nearly two miles.

BANNING, CAL.—C. H. L. Ghreist & Son, who will install an electrical distributing system here, announces that work will be commenced immediately. The same company has been granted a franchise in Mojave also, and will install a plant there.

CATHLAMET, WASH.—The council has taken preliminary steps for the installation of a municipal lighting plant. Power is to be furnished by a distillate engine, but waters of Elocaman River, 10 miles distant will be utilized later. The estimated cost of the initial unit is $4200.

LOS ANGELES, CAL.—The contract for improvement work in the Lankershim Lighting District has been awarded to the Newberry-Bendheim Electric Company. Returns from elections for the formation of Newhall and Lancaster Lighting District were canvassed and resolutions adopted forming the districts.

BOISE, IDAHO.—The council will cancel the contract with the Idaho-Oregon Light & Power Company for installing lamps and furnishing power for lighting the streets of South Boise and the city will install its own system and attach to the rectifiers which have been installed for use for the Central street system.

TELEPHONE AND TELEGRAPH.

VENTURA, CAL.—The Pacific Telephone & Telegraph Company will in the immediate future expend $15,890 on replacing poles between Ventura and Carpinteria.

BLYTHE, CAL.—The franchise applied for by Floyd Brown for the operation of a telephone and telegraph system here for a period of 50 years, will be sold to the highest bidder on September 21st.

LOS ANGELES, CAL.—The Whittier Home Telephone & Telegraph Company has been granted a franchise to erect a telephone and telegraph system upon certain public highways in Los Angeles county.

LEWISTON, IDAHO.—Approximately 13,800 will be expended here on exchange of poles, aerial wire, aerial and underground cable construction, repairs, etc., by the Pacific Telephone & Telegraph Company.

ASTORIA, ORE.—Astoria is to have a wireless telegraph station to be erected by the Marconi Wireless Telegraph Company on the tract recently purchased at the Hess place. Work on the construction will commence immediately.

SAN FRANCISCO, CAL.—The Marconi Wireless Company's new receiving and sending station near Honolulu is about completed. The stations at Bolinas and Marshall bays, in Marin county, are also completed, and the messages will begin to flash between Hawaii and this coast September 20th.

SAN FRANCISCO, CAL.—In order to preserve strictly the neutrality laws Admiral Chas. F. Pond, commander of the 12th naval station, has taken added precautions to insure the sealing of all wireless apparatus on ships belonging to any of the belligerent nations. Pond's order calls for a weekly inspection of all merchant vessels whose wireless has been sealed. The first step in this direction was taken with the arrival last week of the Chiyo Maru. Hereafter the U. S. S. Raleigh will keep a close watch on merchant vessels, an officer from the American cruiser being detailed to inspect all the ships of the warring nations each Monday. Upon the arrival of ships, a commissioned officer will be detailed to board them and seal the wireless by force, if necessary. The ship's master will be notified that the wireless seal must not be broken until permission is given and after he has cleared and reached the high seas. Inspectors of wireless outfits will make written reports to the supervisor of the district.